Science

ENGINEERING AND
MINING JOURNAL

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

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T. A. Rickard discusses

"Mining Affairs in London"

with comments on British and American interests in Northern Rhodesia, conditions on the Rand and in Western Australia, and the economic position of the mining industry as seen in this world metropolis

❖

The Verde Central Flume Line - - - By Leon W. Dupuy

Recovering Silver from Scrap Metal - - - By F. A. Collins

Mining and the California Franchise Tax Law, By J. S. Wallace

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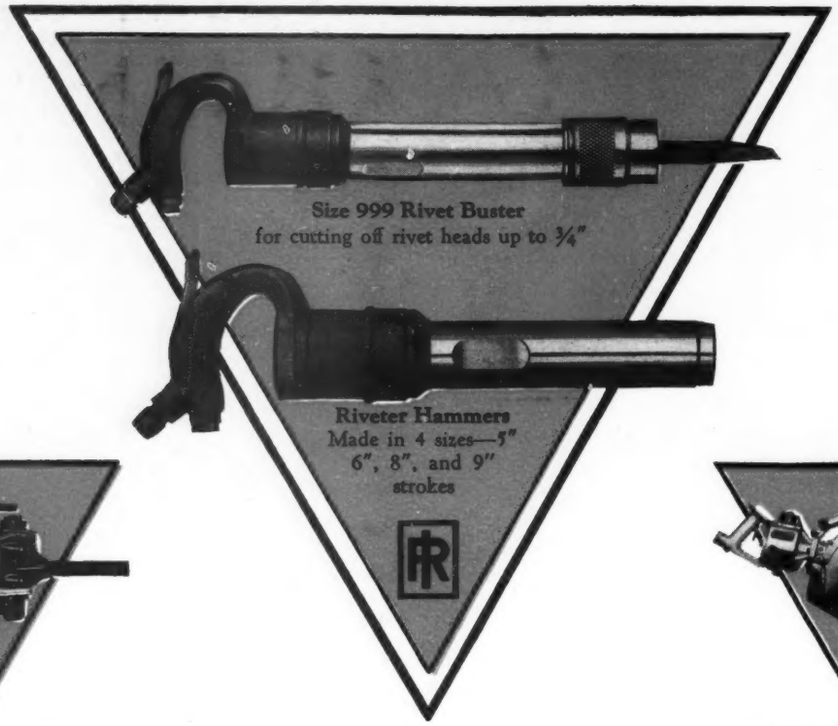

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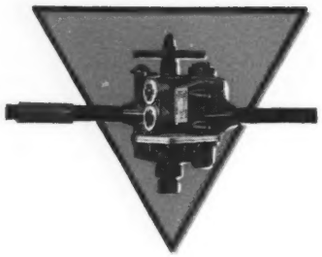

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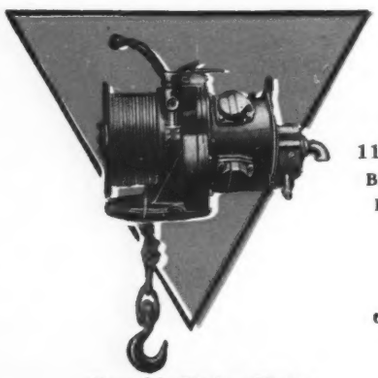

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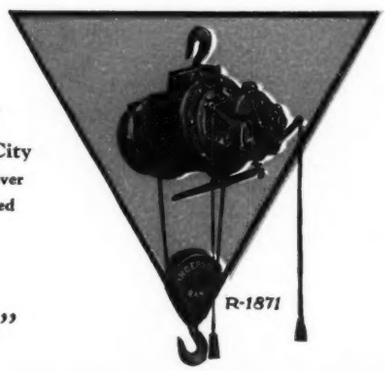

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Volume 128 Number 5

ENGINEERING AND MINING JOURNAL

A consolidation of "Engineering and Mining Journal" and "Mining and Scientific Press"

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First Consult a Reference Book

"COULD you send me a list of some of the best universities or schools of mining in the Southwest? If you would include the names of the deans or other persons to whom I should direct a letter, I would appreciate it very much." This communication is typical of scores that arrive at the editorial offices of *Engineering and Mining Journal*. Such requests are invariably courteously worded, and they deserve prompt and courteous replies. At times, however, routine editorial duties, absences on field work, staff changes, vacation intermissions—to say nothing of the effect of prevailing heat and humidity—make congestion and delay inevitable. The impatient correspondent may suggest that the editorial staff be augmented to take care of such extra service. To this we would demur, with the engineer's distaste for needless waste and avoidable inefficiency. The information requested by the correspondent whose letter is quoted is checked yearly and published in the Annual Review Number of *E.&M.J.*, together with a mass of other data that will, if referred to, answer most of the questions that avalanche into this office.

We are anxious to be of service; but time and postage stamps and stationery would be saved in large quantities, and we could give better service to the industry at large, if subscribers would familiarize themselves with the contents of *Engineering and Mining Journal*, especially of the Annual Review Number, and use the index that is sent gratis with the final issue of each half yearly volume.

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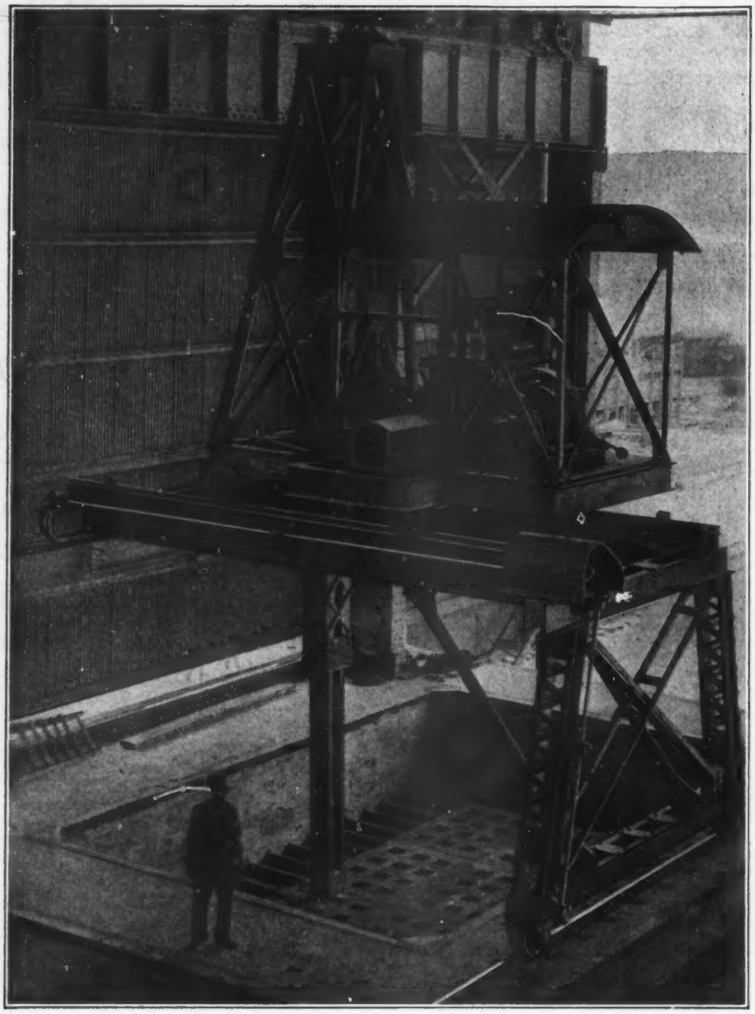

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Labor Economy in Use of Copper as Water Tubing

THE greatest boost that copper has received in any single announcement is contained in a double-page color spread advertisement in the *Saturday Evening Post* for July 20, 1929, featuring the copper water tubing manufactured by the Chase Brass & Copper Company, of Waterbury, Connecticut. A wide adoption of copper tubing is inevitable eventually, but the Chase advertisement is so packed with selling points that no one could doubt the wholesome effect it will have on the sales of the Chase company and on the prosperity of the entire copper industry.

The advantages of utilizing copper as tubing for the conveyance of water go far beyond the high quality of the metal. Copper tubing is flexible, and can be laid between walls and around corners as easily as can electric wiring; yet it is resistant to moderate blows. An internal water pressure of over 3,000 pounds can be withstood. No danger of cracking need be feared if the contained water is allowed to freeze, and the tubing and connections will withstand a temperature nearly twice that of boiling water. The resistance to corrosion of copper is well known, the advertised product being of 99.9 per cent purity. One of the most persuasive selling arguments in favor of copper tubing, however, is the ease with which connections can be made, and the economy secured in the small number of fittings needed.

Copper tubing does not have to be threaded! A fitting somewhat similar to that which has proved so efficient in automobiles gas and oil lines is used—capable of withstanding a tremendous pull without the least danger of coming apart, and providing a high factor of safety against the effect of abnormal internal pressure. The simpler type of pipe connection, moreover, obviates the complication of pipe threading, with its attendant disadvantages of time loss and the need for heavy threading equipment. Labor, of course, is reduced to a minimum. In summary, a considerable expansion in the use of copper can be expected when the pure metal is used extensively for tubing, in conjunction with a simple connection such as that featured by the Chase company.

Pipe fitters will not take kindly to the innovation, and a small amount of technologic unemployment will result, temporarily at least. But the economies and other advantages resulting from the more efficient use of copper will provide a sufficient outlet for employment in other fields of endeavor. To delay progress for fear that an unemployment problem may be involved indicates poor business statemanship. The task of remedying a condition of technologic unemployment, as has been proved in the United States, is far easier than the task of overcoming the disadvantages inherent to costly, wasteful, and inefficient methods.

Getting the Most From a Subscription to *E.&M.J.*

TELEPHONE INQUIRIES and correspondence from those who seek information about articles in back issues indicate that *Engineering and Mining Journal* is considered valuable as a book of reference as well as a chronicle of current technologic progress. Ordinary subscribers who have their copies bound at the end of each half year are doubtless in the minority, because of the cost. An economical alternative to this is possible, however, by which nearly all the advantages of binding may be realized, to the avoidance of disappointment or delay because of misplaced or lost issues when reference to back numbers is necessary. Many of our readers have doubtless put into effect some plan of home binding; but for the benefit of others we commend a simple system, which makes for efficiency, neatness, and ready accessibility, used by an engineer in his laboratory library. The durability of his home-bound volumes is evidenced by the fact that some have been in service for more than twenty years and are still in good condition.

Covers, wire staples, and all matter except text are first removed. The pack of issues that constitutes the volume is then stacked in order, the index placed first. Two pieces of two-inch board are then taken, one 14x3 inches and the other 16x3 inches. The shorter is placed underneath the volume, in line with and about one-half inch away from the binding edge, extending one inch at each end beyond the top and bottom edges. The second piece is then placed in the same position on top of the volume, to extend one inch at one end and three inches at the other. These binding boards are then firmly held in place by clamps or bolts. With the longer board toward the operator, and its extension to the right, the pack is then placed so that the lower edge of the shorter board rests on the edge of a bench, the extension of the longer piece being held in a vise. The binding edge is then sawed to a depth of one-quarter or three-eighths of an inch, about five notches being made, spaced equidistant. The backbone is then well painted with white glue, which has been liquefied by heat. A piece of strong cord is then taken; and, starting at an end notch, this is laid in the notches, from one side to the other, until the last is reached; then passed back in the same manner and tied to the starting end. Another coat of glue is added, to be covered with a strip of strong muslin. The glue must be allowed to set before the clamps are removed. A covering of stout brown paper or other suitable material may be used as a protection of the first and last pages of the volume.

The comparatively small amount of labor needed semiannually to assemble twenty-six issues in convenient and accessible form will soon be forgotten in the advantages

resulting. We believe that the plan only needs a wider publicity to be adopted generally, as an alternative to the stacking of back issues of *Engineering and Mining Journal* in unsightly and inconvenient piles, whereby occasional copies are lost and the tracing of an article is difficult.

No Secrets—The Secret of Technical Success

SCIENCE, technology, engineering — the marvelous advances made in recent years can be traced directly to the growing spirit of intellectual honesty and frank publicity. No investment is more profitable than a generosity in the giving of information that at once establishes the donor as a broad-minded authority. An obvious duty to industry is to contribute one's share to prevent the needless waste involved in futile experiment and duplicated research.

The above comments are taken from an article to be found in a recent issue of *The Magazine of Business,* in which the author sketches the development of the spirit of reciprocity that marks sane practice today. Formerly, the jealous guarding of trade secrets was considered evidence of commendable astuteness, one is told. The individual who encouraged such tactics rarely gave a thought to the good of his particular industry as a whole; he lost no sleep in worrying over the problem of national unemployment. If competition resulted in the death of the competitor—that was merely evidence of the survival of the fittest. Behind closed doors and in guarded laboratories he and his men dwelt apart from the world.

Came gradual reformation with the realization that much of present-day success is the outcome of the accumulation of centuries of achievement. A long-dormant sense of obligation stirred—that those of today should add their share to the melting pot of knowledge. Followed the suggestion that frankness might be good business. A trial proved this to be so. As Dean F. H. Probert of the University of California has said, the failure to exchange experiences is an outstanding cause of inefficiency. Operations behind closed doors lock out much more than they lock in.

Inevitability of Mergers Again Demonstrated in the Mining Industry

THE recent acquisition by Anaconda Copper of Greene Cananea and Andes Copper is further evidence within the mining industry of a pronounced economic trend that is steadily assuming greater proportions. Mergers and absorptions in the last few months have followed each other in swift succession, being exemplified particularly by the formation of a $70,000,000 controlling company in the aviation industry, a new power amalgamation, organization of a $500,000,000 food-producing corporation, consolidation of two of America's largest department stores, and several groupings of important banking interests.

Some would see in the centralized control resulting from such combinations in industry a threat to local self-government and the sacrifice of individualism, with federal agencies absorbing much of the authority possessed by the states. Alarms of this character are natural; any trend of such magnitude and so affecting the life of every citizen may be expected to arouse lively critical discussion. But, in this instance, a significant sequel has been the lack of popular protest. Public opinion apparently indorses the movement, considering it a beneficent sign of the times, as well as an inevitable factor in the application of those mass-production methods that are exerting an ever-increasing influence on society.

The large organization in the mining industry that controls numerous properties, reduction plants, and allied vertical units has demonstrated repeatedly its greater economic value, compared with the small company. For instance, an analysis of statistics of the copper industry for the twenty years from 1909 to 1928, during which period the price of copper remained almost constant, although the average of commodity prices increased 50 per cent, showed that the amount of copper produced by the larger companies increased, whereas the output of the small producers declined; moreover, the larger companies were able to prosper, or at least to survive, during this period of low prices. Most of the small companies, on the other hand, had to stop production or to operate at a loss.

These facts lend encouragement to the belief that consolidations effected, pending, and in prospect in the mining industry are beneficial, and that an increasing tendency toward the coalescence of units in many an industry and business is inevitable.

Even Liquid Oxygen Involves an Explosion Hazard

EARLY last month came news of a serious explosion at Chuquicamata, Chile, which, like most reports of accidents, was considerably magnified, a London metal paper announcing that "the whole dynamite stock of the mine, containing several hundreds of tons, is said to have exploded, the shock being felt as far away as Calama, on the Antofagasta-Oruro Railway. Already the death roll amounts to 200, mainly miners." However, it was not dynamite but LOX that exploded—several hundred pounds instead of tons; and nine men were killed instead of 200. Still, it was a serious accident, and one that has caused the mining company no little concern.

One is reminded of the premature explosion at the same property a couple of years ago, when two men were killed. An investigation of that accident established the fact that a cartridge became wedged in one of the drillholes. In attempting to remove it with a copper spear, rocks were dislodged, which striking together, probably caused a spark that ignited the charge. Since that unfortunate incident safety precautions have been redoubled. A survey of the electrical potentials in the ground, caused by so-called "stray" currents, has become customary in various parts of the holes, operators having found that the potentials at the top and bottom of a charge may differ by as much as a volt,

thus making a spark discharge possible. To obviate this, various parts of the charge are bonded together, and copper connections are provided to carry off static electricity that may be developed in charging the hole. Also, before charging, the hole is inspected by reflected light from a mirror, to make sure of the absence of any projection from the walls that might cause a cartridge to become lodged in the barrel of the hole. Concussion between pieces of quartz and pyrite is especially likely to produce sparks when attempt is made to dislodge such a cartridge with a copper-tipped or wooden spear. Loading a recently sprung hole with LOX or other explosive is never attempted, because such practice is dangerous, the heat being sufficient in some instances to ignite a charge. This could not have happened in the recent accident, for springing had been completed several days previously. So far, the cause of the accident is unexplainable. Absence of hazard in digging into missed holes is one of the important points in favor of LOX, but accidents can happen with this explosive as well as with dynamite, in spite of thorough precautions, as evident by the recent experience in Chile.

Correspondence as a Means of Personal Contact

THE dean of a prominent and successful school of mining writes, *inter alia,* as follows: "For over two weeks now I have been reading both intensively and extensively in the field of technical literature, and I am constrained to write you a word of appreciation of the helpfulness of *Engineering and Mining Journal.* As the several issues are made available I glance through them, reading only such items as are of immediate importance, reserving other articles for the time when I have the leisure to study them. In the survey, however, which I am now making, I have found many suggestions from your varied editorials."

The tribute is welcome and appreciated, but the approbation prompts a closer examination of what has been done and what is planned; and the result, though showing some progress, is not without discouragement. Even a technical magazine, to be successful, must depend to a large extent on personal contact for the injection of the right spirit into its pages. But it is satisfactory to realize that this personal contact can be established by correspondence.

At a meeting held some years ago in Los Angeles a prominent and distinguished mining engineer was a guest speaker. One spontaneous remark of his must remain indelibly in the memories of those present: "I wish I knew you all personally." He realized that personal contact engenders co-operation and mutual respect, removing barriers that arise from diffidence, misunderstanding, and apparent insincerity.

The editors of *Engineering and Mining Journal* return from what excursions they can make into the field with an appreciation of the value of personality as the motivating and directing force of technical progress; but with the conviction that correspondence is an essential auxiliary by which the necessary contacts with the world of mining can be formed and cemented.

Bureau of Mines Responds Promptly to a Suggestion

AT THE February meeting of the A.I.M.E. in New York, the Bureau of Mines' program for disseminating information on geophysical prospecting was critized by a member, who said that he could not see what the Bureau gained by its experiments with "patented" methods. He suggested that it might better study some specific problem, such as the conductivity of rocks. Whatever the merits of the criticism, the Bureau has made quick response. The week's mail brings to hand its latest Information Circular, No. 6,141, in which Mr. M. W. Pullen describes a tentative method for making resistivity measurement of drill cores and hand specimens of rocks and ores. This, the Bureau announces, is the first of a series of papers to be written dealing with the measurement of geophysical constants to aid in prospecting. After a sufficient number of these papers have been published and discussed, a systematic program of measurement for classification purposes will be considered.

This June response to a February criticism must surely gratify the critic. And those other critics who at times dwell on the slowness of bureaus and bureaucrats in getting anything accomplished must admit that the Bureau of Mines is surely "stepping on the gas." Under Director Turner it is getting results of practical value to the industry and the public, and with unwonted speed. Will the critic of last February now object because the Bureau has dealt with "resistivity" instead of with its antithesis, conductivity?

A Reminder of the Dollar's Declining Purchasing Power

ANOTHER STEP in the direction of governmental efficiency and economy is seen in the change in currency recently put into effect in the United States. The new bills are much smaller than were their predecessors, but they are still of adequate size. A saving of about one million dollars per annum to the Treasury in production costs is expected as one result. Other countries with paper currencies of unwieldy dimensions might well consider a change also.

Incidentally, the new United States currency when compared with the older currency indicates roughly how the purchasing power of the American dollar has declined since pre-war times. The new bills are about two-thirds the size of those they displace. As the National Industrial Board has pointed out, the dollar of today has a purchasing power equivalent to about sixty-three cents in terms of the pre-war dollar. The cost of some commodities has remained stationary. A few have declined in value. The cost of clothing has risen until it has become a burden to the male, financially as well as materially. The Board's study indicates that the charges of physicians and the cost of recreation have reached a new high point—a significant fact on which much might be written as to its effect on national health and efficiency. The tendency is not a satisfactory one. If and when a bill is specially issued for payments of such a character, it will have to approximate the size of a postage stamp to indicate its relative purchasing power.

Recovering Silver from

The raw "scrap"
as received
at the refinery

The finished product
ready for
shipment

Scrap Material

and Preparing the Metal for the Trade

By F. A. Collins

IN RECENT years silver has been used more extensively in the industries than ever before, particularly in America, where increased wealth, with its accompanying purchasing power, has increased greatly the consumption of the metal in the arts, especially in the jewelry trade. A large portion of the world's silver passes through New York City, which, since the World War, has supplanted London as the chief distributing center for the metal. Mints of many governments, as well as various industries, draw constantly on this supply.

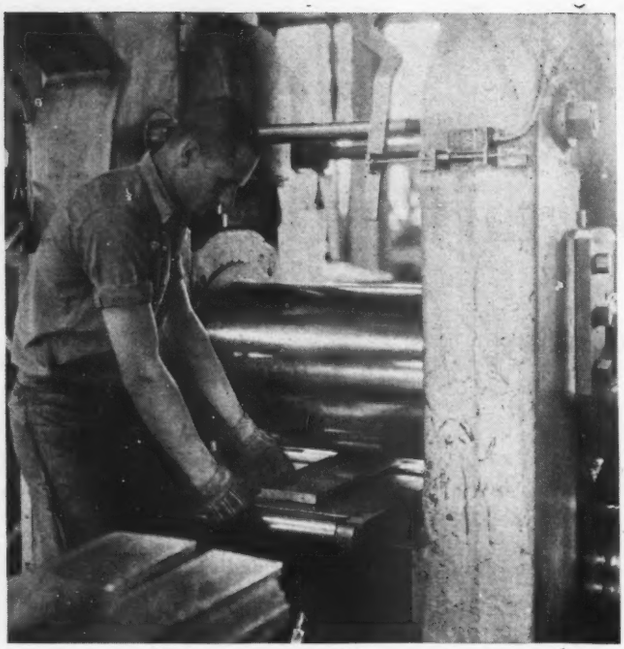
World production of silver last year was about 250,000,000 oz.; of this amount the United States supplied 56,000,000 oz. A portion of this output goes to the government mints of China and Mexico. In the United States the chief demand for silver is in the jewelry and other trades, which demand is greater at present than that of the same industries in any other country. Consumption in the United States and Canada is estimated at 33,500,000 oz., the sterling silverware manufacturers being the most important consumers. England absorbed last year about 6,000,000 oz. of the metal for such uses. In no country in the world is silverware so widely distributed as it is today in the United States. In past generations a silver service was considered a luxury to be enjoyed only by the wealthy, whereas at present silver in some form is to be found in the majority of American homes.

Refining of silver and its preparation for innumerable uses in the arts and trades in America constitute an important industry, employing various processes which have been reduced to an exact science. The needs of the silversmith, for instance, are anticipated as never before, so that he may be supplied with silver in the most convenient form for his purposes. Moreover, silver is filling long-felt wants in other trades, and the metal is now available for many widely different uses. In the past an immense amount of silver and gold was allowed to go to waste through lack of scientific methods in refining. The Romans refined large quantities of silver, but very crudely. Centuries later refiners, employing modern scientific methods, again worked over the refuse dumps of the old Roman silver smelters and recovered many millions of dollars' worth of metal.

One of the most interesting features of the industry today is the practice of reclaiming silver from waste products. Government statisticians estimate that more than 10,000,000 oz. of fine silver, valued in excess of $5,000,000, is annually recovered from scrap heaps. Much of this waste was thrown away or lost in the past, because of the unscientific recovery methods employed. The waste products now treated so carefully include, for instance, the sweepings from the floors of shops where silver is handled, and the water used in washing down walls or old woodwork in the factories or shops. One of the most important sources of supply is the film used in the motion picture industry; this is sent to the refiners by the carload and even by the train load.

Waste products often bear only a very remote resemblance to the beautiful finished product of the refiner's art. The material, in such instances, is first sorted with the aid of shovels and rakes into convenient piles. Then it is burned at high temperatures or evaporated until it has been thoroughly disintegrated, which treatment sometimes must be continuous for several days. Subsequently, the material is ground by machinery to a fine dry powder. Tons of waste are thus ultimately reduced to piles of brownish dust which must be carefully guarded because of their potential value. As a pile of a few bushels of this dust may contain silver worth $100,000 or more, assaying of the dust must be carried out with extreme accuracy. A small sample of the pile of dust is obtained for assay, and great care is exercised to make the sample representative of the whole. The pile is first thoroughly mixed by shoveling; then it is divided into four parts and a sample taken from two diagonally opposite parts. This in turn is mixed and again divided, and the process repeated several times. The handful of dust or "sweepings," as they are called, is then taken to the chemical laboratory to be tested. The entire consignment of sweepings is paid for according to the percentage of

A gas-fired melting furnace



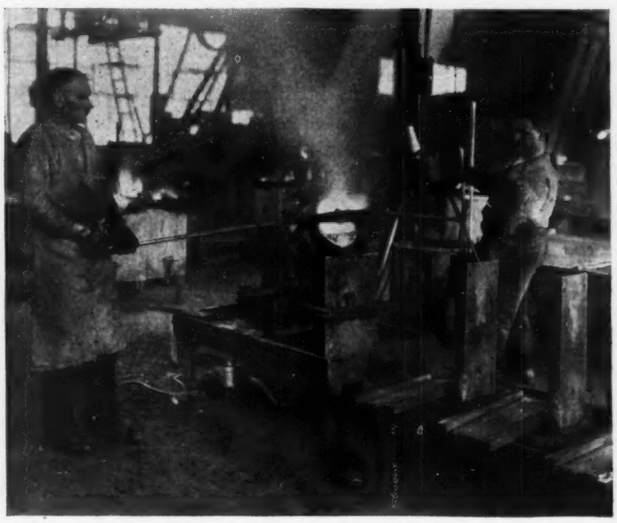
"Breaking down" sterling bars in a rolling mill preparatory to making silver into flat and hollow ware

silver found in the sample, so that accuracy is very important to all concerned.

Modern scientific methods assure the purity of the finished product. Throughout the process of refining, tests of the metal are made hourly and if these tests indicate that the condition of the silver is unsatisfactory, the entire batch is treated anew. Impurities of the mass must ultimately be less than 0.001 of the weight of the metal. Legal requirements for sterling silver are 925/1,000 fine. Pure silver assays 0.999 or even better. Jewelers and manufacturers who buy silver today are thus assured of its quality. The spectroscope is employed in some American refineries to determine the presence of silver and other precious metals in the ores submitted for test. The sample is volatilized in an arc, and the light thus emitted is observed just as observations are made of sunlight by astronomers to determine the composition of the sun. By means of photographs obtained with the spectroscope, the presence of metals, even in the minutest traces, is determined with absolute accuracy.

A modern silver-smelting plant is much more complicated than is generally supposed. A staff of chemists, who are specialists in their lines, are employed to direct every detail of the long and difficult process of refining, and, as the result of long experiment, the expense involved has been minimized to the advantage of all concerned. Conversion of the piles of rubbish containing silver into the bars of glistening metal requires several days. The period has been reduced recently by the employment of electricity at almost every stage of the smelting process. Electric furnaces convert the waste to molten metal; heavy crucibles are moved electrically by merely touching a button; and molds are moved on an electric railway. The silver comes from the refining process in the form of bars having tapering sides and weighing 70 lb. or more. It is then "broken down" with the aid of powerful and ingenious machinery into many forms convenient for the use of the jeweler and manufacturer, usually being rolled out into sheets and ribbons of various widths and thicknesses. These are cut or stamped into innumerable forms convenient for the silversmiths to handle. Formerly the silver was supplied to the silversmith in bars or in sheets, necessitating an immense amount of work, whereas today much of the preliminary labor is thus saved. An interesting example of the equipment employed is the machine used for making silver wire of various diameters. In this device the silver is transformed into glistening wire by being drawn at astonishing speed through diamond or sapphire dies.

One of the most important storehouses for silver in the world, and perhaps the richest, is a vault directly beneath the pavement of a street in the financial district of New York City. Not infrequently 5,000,000 oz. of silver is stored there, and at times twice this amount of the metal reposes in the vaults. Inasmuch as the interest mounts rapidly on the potential millions which such quantities of silver represent, the metal is not retained in the vault for more than a few hours at a time. Handling of this great wealth in silver has been carefully organized to assure its safety. The ingots stored directly beneath the



Completing a "pour" of silver into ingot

busy sidewalk are raised by electric elevators to the street level for shipment and transported through the streets by means of armored cars or caged wagons under guard. The elevators lift the silver to within a few feet of the entrance to the delivery vehicles, so that it is exposed as little as possible. In making silver shipments abroad the metal is transported quickly by motor truck to the near-by docks and transferred under guard to the "specie rooms" or vaults especially arranged for it aboard the ocean liners. China and Mexico are important silver-consuming countries, because of their silver currency, and there is a constant stream of the metal into Asia. One steamer travels westward by way of the Panama Canal and the second eastward via Suez.

Handling of silver entails practically no loss. A hold-up with the intent of obtaining silver is unknown in New York City. Transportation is so safe that the insurance rate to India is only 15c. per $100 worth of silver and the rate to Europe is much less. The silver is handled "naked"—that is, without being crated or boxed in any way. Loss due to "scratching" averages only about 50 oz. for every 100,000 oz. shipped, which is considered negligible.

Mining Affairs in London

By T. A. RICKARD

A RECENT SOJOURN in London, bringing with it numerous pleasant contacts with members of our profession, prompts me to record sundry impressions and some possibly new information concerning the mining industry as conducted at the capital of the British Commonwealth.

Shortly after my arrival in London from the eastern Mediterranean I was a guest at the annual dinner, at the Hotel Cecil, of the Institution of Mining and Metallurgy, a professional organization that worthily represents the mining engineers and metallurgists on whom devolves the task of directing the manifold technical operations of a far-flung industry under the British flag. Such an occasion was certain to be symptomatic. The president of the Institution, Mr. S. J. Truscott, the Professor of Mining in the Royal School of Mines, was in the chair, but the duties of toastmaster were performed, as is customary, by a gold-laced functionary equipped with a resonant voice and excellent diction, together with complete familiarity with all the honorific titles belonging to the successive speakers. This use of a professional toastmaster is a commendable custom, because, among other things, it shortens the introductory speeches and saves the audience from the banalities that sometimes mar similar occasions, when the gentleman presiding becomes too prolix and too free with his personal allusions. It gives dignity to the performance, and saves time.

Professor Truscott, when his turn came to respond to the toast of the Institution, spoke with the charmingly quiet and engaging manner that marks the cultivated Englishman. In his modest remarks he laid stress upon "management" in mining affairs, "that," he said, "involves more than the functions of officials, the manager and his staff; it includes also the functions of the directors, both financial and technical. Viewed in that wide sense, the community looked to management for equitable service and labor looked to management for equitable dealing. This brought management and labor into adjustment. Politically one heard a great deal about the capitalist's power, but from an industrial point of view, management and labor were the important factors, and of these it is management that carries the chief responsibility." The more spacious speeches were delivered not by members of the profession but by official, and titled, guests, who it seemed to me talked in a somewhat patronizing manner both of the mining engineer and of the basic industry to which Britain's greatness has been, and is still, so largely due. The most significant remark uttered on this auspicious occasion was made at the close of the last speech by a public man—indeed, a statesman—honorably known on both sides of the Atlantic. This was Sir Auckland Geddes, recently British Ambassador at Washington and now chairman of the Rio Tinto company.

Earlier in the evening, Sir Halford Mackinder, the chairman of the Imperial Economic Committee, had raised the bogey of national metal control and had animadverted on the German octopus, the Metallgesellschaft, of pre-war days. Sir Auckland smilingly, if not derisively, swept aside the ghost of an earlier time and welcomed internationalization of the mining industry. "It is only," he said, "through nation working with nation, forgetting national boundaries, that we shall reach ultimately to the only possible solution as the result of which the mineral resources of the earth's crust will be placed on equal terms at the disposal of all humanity." The Metallgesellschaft was once a bugbear, but is now a partner. "It is well, and it is inevitable." The Rio Tinto company, for example, he told us, in its business of marketing cupriferous pyrite, is associated commercially with other companies, American, Belgian, French, and Spanish, and also to a less degree with Norwegian and Swedish groups. So, I may add, the English company operating mines near Huelva, in Spain, is setting an example in that international cooperation to which thoughtful men look as an anchor to windward against the recurrence of another exhibition of the obscene insanity of war. Thus the last words of the last speech were the most memorable of this interesting dinner.

TWO WEEKS LATER I was again a guest of another professional organization, the Iron and Steel Institute. The president, who was in the chair, is Mr. Henry Louis, Professor of Mining in Durham University, and, like my friend Truscott, a fellow alumnus of the Royal School of Mines. The principal toast, that of the Institute, was proposed in a long speech by the Right Honorable Sir Philip Cunliffe-Lister, K. B. E., M. P., the President of the Board of Trade. Like most such speeches by government officials, it suggested a patronizing pose toward the professional gentlemen whom he addressed. The prefixes and suffixes that appertained of right to the speaker gave him, as the merest amateur in technology, the hardihood needed for such a performance. "Co-ordination is necessary," he remarked, "and no less important in the home market than in the export trade in order to eliminate wasteful competition." What was needed was not to put up prices, but to bring down the costs of production. A Solomon come to judgment! There was much said about resources and assets, but not nearly enough about the men that made them liquid. In no domain of human industry has inventive skill played a more decisive part than in the English iron and steel business, and it was to her technicians, such as Darby, Cort, Neilson, Bessemer, Gilchrist, and Thomas, not less than to her resources in ore and fuel, that England owed her industrial dominance during the nineteenth century and during the first decade of the twentieth. Every advancement in this art was initiated by members of the Institute, past and present.

Professor Louis suggested that more aid to scientific research might be better for the country than the increased facilities for drinking tea! This being a reference to the recent removal of the import duty.

He laid stress on the fact that the scientific societies were crippled by lack of funds and that the levying of the income tax on the receipts of such societies was inexcusable. To an American these annual dinners are interesting in their differences from his own similar affairs, the chief one being the fact that the principal speaking is done not by the members but by guests, usually officials in the government service, the apparent pupose being one that should be wholly unnecessary—namely, to awaken such gentlemen to the importance of the mining industry and of the men in charge of its enormous activities.

WHILE I was in London the newspapers were full of comment concerning the issue of 1,500,000 new shares, by the General Electric Company, an English enterprise, registered in London, these shares being restricted to British purchasers. Instant protest from a large body of American shareholders caused the proposal eventually to be dropped, but not before the German origin of Sir Hugo Hirst, the pseudo-patriotic chairman of the company, had been emphasized and the total absence of any desire on the part of the American stockholders to control the company had been clearly asserted. This fear of American control of British companies, more particularly of domestic business, has become the bugbear of Anglo-American finance. Here I may mention the fact that the Royal Mail steamship company, which received its first royal charter in 1839, is subject to the limitation that no alien may hold capital stock in the company or serve as a director. These restrictions, of course, are antiquated; they are a belated survival from the small scope of business participation of former days, and will be recognized at their proper lack of worthiness. In years gone by our American railroads were largely controlled by British capital, not to mention a large number of our richest mines, but I am not aware that we regarded such ownership as a menace or a blight. The question will arise shortly in connection with the Northern Rhodesian copper mines, the shares of which have been, and are being, absorbed largely by American companies and individuals. Surely capital is non-national, and equally surely the joint participation of various nationals in productive enterprise is of good augury for the maintenance of the peace of the world?

AT THE time of my visit the tin market was apprehensive on account of the overproduction of the metal, the consumption having failed to keep pace. The margin between production and consumption is slight, but owing to the small output of tin as compared with the other useful metals (tin, 150,000 tons; copper, 2,000,000 tons annually, for example), the quotation for tin is extremely sensitive; indeed, it is so sensitive as to cause dealings to partake of a gambling character. The tin-mining industry is one in which British capital continues to predominate, the chief producing regions being under the British flag, notably Burma, the Malay Peninsula, and Nigeria. In the islands of Banka and Billiton the alluvial mines are controlled by the Dutch, whereas in Bolivia the control is mainly American. The English and Australian shareholders have done well out of the Malayan mines, most of which have escaped excessive capitalization and share-rigging, as compared with the gold-mining companies of the Rand and of Western Australia. Dividends paid by the Malayan mines are high, from 10 to 40 per cent on the original capital, and the lives of the enterprises are comfortably long, say from fifteen to thirty years.

A lot of money has been made during the last fifty years in the Malay States, including operations by the Chinese on their own account, but it is a significant fact that these alluvial operations of the Chinese, by the method known as *lombong* (which means pumping or tramming from an open pit into sluice boxes), now answerable for over half of the total output, are approaching the end. The diminution of tin from this source may have a decisive effect on the metal market within the next three years, provided no new tin district is discovered. The idea that tin is likely to become so scarce as to cease to have an industrial use, a prohibitive price stimulating the employment of substitutes, is not warranted by a careful study of the statistical chart. Of the mines operated by others than the Chinese, the larger number are worked by dredges, and a few by hydraulicking, the chief of these being the Gopeng. Lode mines are exceptional in the Malay region, the principal being the Pahang Consolidated, an old company. Intensive prospecting, by boring, for new deposits during recent years has been scantily rewarded, so that from the dredging point of view the possibilities of the peninsula are shrinking rapidly. At the present time the tin-mining industry of Malaya appears to have reached its zenith, a conclusion that is of much significance, of course, to the metal market.

WESTERN AUSTRALIA has lost most of its importance as a gold field. The production last year was only 393,399 oz., worth $8,805,000, as compared with 617,977 oz., worth $13,123,600, in 1920, whereas in 1903 the output was worth $42,678,319. However, today the mining industry of this Australian state shows signs of recovery, thanks to developments consequent upon the new capital expended by the Lake View & Star and Wiluna companies, the former controlling seventeen mines, of which the chief are the Golden Horseshoe and the Chaffers, both at Kalgoorlie. The Wiluna is a relatively new mine situated 120 miles east of Meekatharra in the extreme northern part of the known mining region. Here, as in other comparatively old mining districts, it has been found advantageous to consolidate various holdings with a view to centralized management of operations and modernized treatment of ore. Each of these two groups expects shortly to be treating an approximately equal tonnage—namely, 40,000 tons per month, or 80,000 in all, at 9.5 dwt. per ton in assay value. Besides these mines there survive the South Kalgurli, Great Boulder Proprietary, Boulder Perseverance, and the old Oroya-Brownhill group, once famous for their richness, all at Kalgoorlie. Northward the Sons of Gwalia, with which Herbert C. Hoover was prominently identified more than twenty years ago, is still productive, by reason mainly of up-to-date power equipment, for which George Klug is responsible.

THE consequence of the recent influx of fresh capital into Western Australia has been a stimulation of the share market in the two major companies, the other stocks remaining quiet because of the known limitation of their resources. The chief personal factors in these developments have been John A. Agnew and Frederick H. Hamilton, together with the firm of James Brothers, consulting engineers to the Lake View & Star, and H. E. Vail, consulting engineer to the Wiluna company. It is worth noting that the healthy condition of the Lake

View & Star is due largely to progressive metallurgical methods, the process now in use being a reversion to the all-roasting treatment, with sundry improvements, notably fine grinding. At the Wiluna the new plant utilizes the most advanced phase of flotation.

Incidentally, it is interesting to note the present participation, on a handsome scale, of the Consolidated Gold Fields of South Africa company in Westralian mining, this participation having started two years ago when the company acquired a large interest in the Wiluna property. The joint enterprises mentioned above will be dependent in some measure upon the attitude of the government of the state in the matter of the relation of the mine managements to the labor unions. My American friends will be amused to learn that, by legal regulations, the mine workers are given two weeks' holiday with full pay at Christmas; this means that in metallurgical plants, especially those involving the use of leaching processes, it is necessary to cease operations for at least three weeks. Moreover, some of the men actually obtain a job elsewhere during their "holiday," and thereby draw double pay. Anomalies or absurdities such as these require correction if a basic industry is to prosper.

THE MINING INDUSTRY of the Rand is holding to its peak of production, thanks largely to the newer mines of the Far Eastern district, together with probably some improvement in technical methods, notably at the West Springs and Modder East mines. The Rand continues to be, by long odds, the premier gold field of the world and the major industrial factor of the African continent, but it is no news to state that it also has reached its zenith of productivity, for the fact is so well recognized that professional interest in the technical operations of mine and mill has sensibly abated, while the share market concentrates its attention on the declining yield of the ore in particular mines such as the Sub Nigel and Robinson Deep. To these may be added the City Deep, for, at the last annual meeting, John Martin, the chairman, had to report a loss on the operations for the year, this being due to a continual decline in the grade of the ore. It is fair to remark, once more, that even Methuselah died!—a lesson the controllers of the Rand have been obtusely slow in learning. Public dealing in Rand shares has dwindled continuously during the last decade, and it may be remarked that the public has been compelled to pocket the losses incidental to an over-valuation that was based upon a failure to recognize an unpleasant geologic fact—namely, that of impoverishment of ore in depth.

HOWEVER, one must not fail to appreciate the critically important part played by the Rand and by the pioneers of the Rand in the industrial development of the African hinterland. With that historic expansion of English activity, political and industrial, we associate chiefly the name of Cecil John Rhodes, but among the mining adventurers, using the term in its old heroic sense, to whom the credit for painting the map of southern Africa with the pink of British proprietorship is to be given, is Robert Williams, who was associated with Rhodes in the early exploratory work done along the Zambesi-Congo watershed. It was a keen pleasure to me to congratulate Sir Robert Williams on the honor of a baronetage recently conferred upon him, an honor much belated, it seems to me, but more than fully earned by the recipient. Trade follows the flag, and the flag follows the pick. It is too little realized in London, particularly in Downing Street, to what degree the expansion of the British Empire has followed upon the footsteps of the prospector, the forerunner of civilization in the dark regions of the earth. Of such forerunners, Sir Robert is one of the most distinguished and effective, the proof of which is to be found in the fact that the chief mining interest in London today centers in Northern Rhodesia, a region that he was the first to explore and a region in which is being developed the major copper district of the modern world.

RECENT remarkable results of extensive prospecting for copper in Northern Rhodesia constitute a great event in mining. The region that is now attracting so much attention is on the southern side of the Zambesi-Congo divide, on the northern slope of which are the celebrated mines of the Katanga, in the Belgian Congo. The height-of-land, or summit of the watershed, is the topographic boundary between Belgian and British territory; it is also of geologic significance, for the ore on the Katanga side is oxidized, whereas that on the Rhodesian side is predominantly sulphidic, this difference, of course, being of critical consequence in the choice of metallurgic method and of decisive importance in the cost of exploitation. When I was in that part of Central Africa four years ago there was no suggestion of the remarkable developments that have ensued. In 1925, the only copper-mining operations were those at Bwana M'Kubwa and N'Changa. The former was an over-rated enterprise dependent upon an extremely interesting but uncertain metallurgic process (the Benedict-Perkins ammonia method), and the other active operation, at N'Changa, consisted of trenching and drilling that had exposed relatively small thicknesses of comparatively low-grade and oxidized ore, in striking contrast with the extremely rich copper ore that was being smelted at the time across the northern border, at Elisabethville, by the Union Minière. On our way from Bwana to N'Changa we were told that work was to be resumed at a place named N'Kana, but there was no inkling then of the extraordinary discoveries that were to ensue from drilling, the effect of which has been to eclipse completely the older Bwana mine (belonging to the same company), with its estimated 7,000,000 tons of 4 per cent copper ore, as against the 25,000,000 of 4½ per cent ore now credited to the N'Kana. As for the N'Changa, instead of a few meagre disclosures of 3 to 4 per cent ore, oxidized, the more recent drilling operations in another part of the concession have proved 15,000,000 tons of 3 per cent mixed ore, oxides and sulphides, and 1,000,000 tons of 4.2 per cent sulphide ore, together with much bigger possibilities, or even probabilities, of higher-grade reserves.

THE beginning of systematic copper exploration in Northern Rhodesia followed upon a report made by Preston K. Horner in 1921. In that report, to the C. V. (Copper Venture) syndicate, Mr. Horner, who is now prominently identified with the regional industry, said that the chances of opening up large tonnages of 3 per cent ore were sufficiently good to warrant an investigation. Working capital of the C. V. syndicate was £5,000, to provide for preliminary scouting. The first work done for the syndicate, of which A. Chester Beatty was a notable member, was to prospect at

N'Kana in 1922. The syndicate became the parent of the Rhodesian Congo Border Concession, this company being organized in 1923, under a working agreement with the British South Africa Company, which is the paramount power in this part of the world, and to which 15,000 shares were given for the concession, besides the obligation of a royalty. Copper Venture syndicate sold the N'Kana portion of its territory to the Bwana M'Kubwa company, which at first concentrated its energies on the old Bwana mine, but in 1928 drilled the N'Kana deposit with astonishing results, proving 24,000,000 tons of 4.2 per cent ore having an average width of 31½ ft., with ample chances of developing further resources. Meanwhile the Bwana M'Kubwa company transferred the right to test the unprospected portion of the N'Kana concession, an area of 1,800 square miles, to the Selection Trust (a Beatty organization), retaining, however, a third interest. Then the Selection Trust transferred its holding to the Rhodesian Selection Trust, which has discovered, by drilling, an enormous orebody at Mufulira—at least 25,000,000 tons of 6 per cent ore. In 1927 the Roan Antelope company was organized to acquire sundry locations from the Northern Rhodesia Company and the Selection Trust, the total area involved being 2,112 acres. When drilled in 1928 this ground proved to be rich, not less than 30,000,000 tons of 3¼ per cent ore being proved in the course of the year.

THIS gives a sketchy outline of the manner in which the chief operating companies came into being. Various groups are interlocked not only in their proprietorship but in their financing and technical direction. The names of sundry gentlemen appear repeatedly on the directorates, the leaders being Mr. Beatty, a mining engineer, and Sir Edmund Davis, a veteran promoter. The name of another mining engineer, Walter Broadbridge, as director, bespeaks the interest of the company he represents, our old friend Minerals Separation, which, by its early participation in the C. V. syndicate, obtained a large holding in the Rhodesian Congo Border Concession and in its progeny the N'Changa Copper Mines, which, I may add, was formed as a subsidiary company in November, 1926. Rhodesian Selection Trust's directorate is interesting because it consists of Mr. Beatty and his engineer associates—namely, William Selkirk, C. W. Boise, J. Archer Dunn, T. F. Field, and George R. Nicolaus.

ANOTHER principal group is the Anglo-American Corporation of South Africa, which is represented on these Rhodesian copper directorates by Sir Ernest Oppenheimer, an astute financier, and by Carl R. Davis, an able technician with wide South African experience. Another kindred company, the Rhodesian Anglo-American, organized to acquire share holdings and to finance undertakings in this region, includes among its directors an honored veteran, Walter McDermott, representing the old Consolidated Mines Selection Company, and one of the most brilliant of our American engineers, Fred Searls, who represents the Newmont corporation, of New York. It is customary in London to indicate the nationality of the directors of a company; it is interesting therefore to note that a recent Roan Antelope report places "U. S. A." after the names of seven directors and alternates—namely, A. Chester Beatty, J. A. Dunn, Charles W. Boise, Carl R. Davis, T. F. Field, B. G. Lathrop, and Dorsey Richardson; four gentlemen, including Mr. Selkirk, are not labeled, being British; and one is marked "British, G. O.," the last meaning "German origin."

The first mineral deposit disclosed in this region was the Kansanshi gold-copper lode, which was discovered in September, 1899, by George Grey, sent thither by Robert Williams. The Roan Antelope lode was discovered in 1904, but it was turned down as a "dud" for twenty years. Meanwhile the Belgians found rich copper ore in the Prince Leopold mine, at Kipushi, just across the near-by border.

THE geological structure of the region is simple; it is an eroded anticline with synclines on both flanks. On the northeastern flank are the Bwana and Mufulira; on the southwestern flank are the Roan, Muliashi, N'Kana, Chambishi, and N'Changa. The copper ore lies in layers, conformable with sediments of shallow-water origin varying in composition from shale to sandstone, from grit to conglomerate. The ore is found at definite horizons in synclinal folds that have been intruded by granite of two periods. Usually, the ore is not far from the contact in basins the edges of which constitute the outcrops. Near the surface the ore is oxidized, but at a shallow depth, two or three hundred feet, it appears in its original sulphide condition.

At first, the Roan orebody was divided between the Roan Antelope and Rietbok, the two upturning edges of the synclinal orebody being mistaken for separate "reefs," until R. J. Parker, manager for the Rhodesian Selection Trust, traced the outcrop as it curved round the toe of the syncline. A glass model of Roan, made by my friend H. A. Titcomb, exhibits this structure vividly, the southern rim of the syncline dipping at about 45 deg., whereas the northern rim is nearly vertical; indeed, in places, it overturns. At 4,500 ft. from the east end, near the Luanshya River, the width of the synclinal basin at surface is 2,000 ft. This width is maintained for 15,000 ft., the pitch of the syncline westward being at 25 deg. down to probably 2,500 ft. vertically. The ore is from 10 to 50 ft. thick, as proved by 31 boreholes. Farther westward the syncline widens in the territory of the Roan Extension and Muliashi, in the latter the rims being 2½ miles apart, in consequence of the junction of two synclines, the second one coming from the northwest, where, in ground belonging to the Rhodesian Selection Trust, a borehole has recently encountered excellent ore. This Muliashi ground belongs to the Muliashi Venture; the Roan Antelope company has an option on it until Oct. 1 of the current year. Needless to say, the option will be exercised, greatly to the aggrandizement of the Roan property.

THE Chambishi, belonging to the Rhodesian Selection Trust, is in the northwestern corner of the concession, on the road from N'Kana to N'Changa. The first boreholes proved disappointing, and it was only when drilling deeper, farther from the rim, within the syncline, that good ore was penetrated. A second line of bores cut into 62 ft. of 3½ per cent ore, 78 ft. of 3 per cent, and 76 ft. of 3 per cent, all on a dip of about 30 deg. Prospects are excellent for a considerable extension of the orebody; the syncline is a large one, and this property evidently is likely to become a big mine.

The Rhodesian Selection Trust has another winner, the Mufulira. This is within 7 miles of the Belgian-Congo border and will be a property of 10,000 acres when the company has exercised its option in the matter

of location. The first borehole, sunk only a year ago, cut three orebodies, dipping at 41 deg., at depths of 291 to 512 ft., penetrating 15, 24, and 16 ft. respectively of copper ore averaging 6 per cent. At Mufulira, the holes are a thousand feet apart and seven of them are in line. The second row is placed to cut the ore at 1,000 ft. vertically. Two of these are now drilling in ore.

Recent cablegrams announce that the second orebody has been cut in two boreholes; the first shows 11 ft. of 2.33 per cent ore from a depth of 999 to 1,014 ft., and 29½ ft. of 4.62 per cent ore from 1,014 to 1,052 ft. This hole is still in ore. The other bore yielded 32 ft. of 4.21 per cent ore from 893 to 1,007 ft. and 32¼ ft. of 5.81 per cent ore from 1,007 to 1,040 ft., and also continues in ore. These discoveries, it must be noted, are being made in a locality 55 miles north of the Roan Antelope mine. The possibilities of an immense tonnage of high-grade ore are beyond peradventure.

Dr. Otto Sussman, in a recent report, estimated the cost of delivering best selected copper from the Roan Antelope at 8.15c. per pound. The smelter, built by A. G. McGregor, of Arizona, is expected to be ready for operation early in 1931. It is understood that Mr. McGregor, in common with many other American technicians familiar with conditions in Rhodesia, has acquired a large shareholding in the Roan and other companies.

The metallurgic recovery said to be expected, in a 55 per cent flotation concentrate, is 95 per cent, the matte obtained from the concentrate running 75 per cent, as Mr. McGregor himself stated in an interview that was published by this journal on Feb. 16 of this year.

The British South Africa has a proprietary interest in this entire region, an interest that is recognized in some cases by placing a representative on the board of the Rhodesian company, and furthermore by the payment of royalty, based upon the price of standard copper, thus:

Copper Price	Royalty	Percentage of Gross Value
£50	£1	2
55	1 4s. 9d.	2½
60	1 10 0	2½
65	2 2 6	3¼
70	2 15 0	3.9
75	3 7 6	4¼
80	4 0 0	5

It is obvious that, in course of time, when the mines advance to fruition, the Chartered company will draw a handsome revenue.

The branch railway, from N'Dola, on the Beira and Mashonaland company's line, reached the Roan Antelope mine last January, and is now in service. Another branch line has been started from Mokambo to Mufulira, a distance of 14 miles. Meanwhile, the Benguela railroad, from Lobito Bay to the Katanga, has been completed to Luao, on the border of Angola and the Belgian Congo; the event was celebrated in June, when an appropriate ceremony marked this belated achievement, the construction having been begun in 1903.

From the sea, on the west coast, to Luao is 837 miles, and there remains 335 miles to be built before connection is made with the trunk line (Cape Town to

Summary of Mufulira Borehole Results

Hole No.	Orebody No.	From, Feet	To, Feet	Dip or Intersect Angle, Degrees	Core Recovery, Per Cent	Length, Feet	True Width, Feet	Total Copper, Per Cent	Oxide Copper, Per Cent
1	1	291.50	312.20	41	Over 85	20.70	15.30	9.49	0.93
	2	391.00	422.75	41	....	31.75	23.80	5.72	0.83
	3	491.00	512.00	41	....	21.00	15.70	5.14	0.82
1	Total			41	....	73.45	54.80	6.61	0.86
2	1	357.00	374.24	43	88	17.24	12.60	8.62	1.12
	2	453.90	474.00	43	83	21.10	15.40	4.21	Tr.
	3	532.00	568.40	43	89	36.40	26.57	4.91	0.03
2	Total			43	87	74.74	54.57	5.57	0.27
3	Stopped at 701 ft. No commercial ore struck.								
4	1	350.00	First ore horizon practically not mineralized.						
	2	405.00	Second ore horizon mineralization slight, carbonate and chalcopyrite.						
	3	472.00	530.00	43	58	58.00	44.43	5.75	1.89
5	1	337.00	363.80	50	96	26.80	20.53	5.47	2.1
	2	429.83	471.00	50	77	41.17	31.53	6.93	Tr.
	3	506.00	549.00	50	89	43.00	27.63	5.28	1.80
5	Total			50	83	110.97	79.69	5.98	1.2
6	Stopped at 615 ft. No commercial ore struck.								
7	1	358.00	370.00	34	58	12.00	10.40	2.83	....
	2	416.00	508.00	34	61	92.00	78.90	4.78	....
7	Total			34	60.6	104.00	89.30	4.55	....
8	1	336.00	365.00	40.5	87.6	29.00	22.30	4.82	....
	2	432.00	466.50	40.5	90.2	34.50	26.80	4.98	....
	3	493.80	554.00	40.5	88.4	60.20	47.50	4.32	....
8	Total			....	80.6	125.70	96.60	4.62	....
	Low-grade ore above third orebody in No. 8 hole.								

Rhodesian Selection Trust is operating the Chambishi, Mufulira, and Muliashi Extension, as well as other prospects. Until November next this company has the right to select 150,000 acres, of which only 40,000 acres as yet has been taken up, but before the expiry of the option the acreage will be about 100,000. All this comes out of the original N'Kana concession. Even after acquiring the enormous territory, as specified above, the Selection Trust will retain a third interest in the remainder, so that one can form a vague notion of its potentialities of development and of profit in the near future.

The accompanying record of the Mufulira drilling results will be appreciated by mining engineers in other parts of the world.

Next, I give a tabulated statement showing the size and grade of the orebodies from N'Dola to N'Changa. This tabulation gives not only the official estimates, as published in the reports of the various companies, but also the unofficial estimates of competent engineers; the latter, of course, being unofficial, should be treated with reserve, but they are interesting and pertinent. The sulphide ore is indicated by an asterisk. The figures give eloquent testimony of the importance of Northern Rhodesia as a copper region.

Bukama) at Tshilongo. This extension is expected to be finished at the end of next year; meanwhile a motor service has been established to overcome the hiatus in the route. It is surprising, one may remark, that the Belgians have not more effectively seconded the splendid efforts of Sir Robert Williams, the originator of this important outlet for Central Africa and the great leader in exploratory work along the Zambesi-Congo watershed. Why did not the Belgians build their end

London by the fact that the Englishman does not pay income tax on share winnings; we pay the full income tax on the gains we make by the buying and selling of stocks, but he is exempt, the funds thus derived being treated as capital. Therefore an Englishman thinks less of dividends (on which he pays 20 per cent tax) than of increments in share value, and can afford to wait for a rise rather better than we can. This favors speculation in non-productive, but promising, mining ventures.

Size and Grade of Orebodies From N'Dola to N'Changa

		Ore Reserves Officially Stated		General Opinion as to Tonnage in Process of Development		—Possible Future Total—	
Name of Company	Name of Mine	Sulphide	Mixed Oxide Sulphide	Sulphide	Mixed Oxide Sulphide	Sulphide	Mixed Oxide Sulphide
Roan Antelope Copper Mines, Ltd.	Roan Antelope	*30,000,000 @ 3.40%	.....	*40,000,000 @ 3.25%	.....	*100,000,000 @ 3.5% Cu.	.....
Bwana M'Kubwa Copper Mines, Ltd.	Bwana M'Kubwa	.....	7,200,000 @ 3.96%	.....	7,200,000 @ 3.96%	*25,000,000 @ 4.0%	7,000,000 @ 3.5%
	N'Kana	*20,000,000 @ 4.2%	4,200,000 @ 4.2%	*25,000,000 @ 4.0%	4,000,000 @ 4.5%	*100,000,000 @ 4.0%	5,000,000 @ 5.0%
N'Changa Copper Mines, Ltd.	N'Changa — Dambo	.....	15,000,000 over 3%	.....	95,000,000 4.5%	.....	150,000,000 @ 4%
	N'Changa — River Lode	*1,000,000 4.2%	.....	*2,000,000 @ 4.5%	.....	*10,000,000 @ 4%	.....
Rhodesian Selection Trust, Ltd.	Mufulira	.....	.....	*25,000,000 @ 6%	.....	*100,000,000 @ 5%	.....
	Chambishi	.....	.....	*10,000,000 @ 3.2%	.....	*25,000,000 @ 3.5%	.....
Totals		*51,000,000 @ 3.73%	26,400,000 @ 3.45%	*102,000,000 @ 4.1%	106,200,000 @ 4.0%	*360,000,000 @ 4.1%	162,000,000 @ 4.0%

of the line so that it might be ready when the railroad reached the border of the Katanga? Now for two years more the usefulness of the enterprise will suffer. Obviously, the railroad route to the west coast is of great importance to the Rhodesian copper mines, for it shortens the sea journey to Europe by 2,600 miles and saves 600 miles of land haulage, by way of the present route to Beira, in Portuguese East Africa.

It is apparent that Northern Rhodesia is destined to become a great producer of copper, and that in time it will displace Arizona as the most productive copper region. Already the future of some of the companies has been handsomely discounted by the share market, so that some of the quotations seem to be dangerously high, but it is impossible to be other than optimistic, because the discoveries, by drilling, advance at an astonishing rate, creating enormous potential reserves of ore from day to day. Just as I was leaving London I heard of 125 ft. of 7 per cent ore being cut half a mile from N'Changa on ground belonging to the Congo Border Concession, at a depth of 620-745 ft. Another bore, 1,500 ft. away, had cut 65 ft. of 8 per cent ore at 800 ft. in depth.

Since beginning to write this article, I note that a cablegram from South Africa announces the cutting of nine feet of 4¼ per cent ore on the N'Kana property at a depth of 2,475 ft., which is the deepest borehole up to the present. The drilling is reported to be still proceeding in ore.

When one remembers what our copper companies in the United States have done with 2 per cent ore, one is bound to feel amazed at the records of these drillings in Africa. Moreover, they are scattered over a huge area, as Mr. George Walker pointed out in this journal of Feb. 2 of the current year. The Bwana is 20 miles from the Roan, 33 miles from N'Kana, 65 from N'Changa, and 47 miles from Mufulira. There remains ample scope for the discovery and development of large mines, of the existence of which as yet there is no suggestion of evidence.

The purchase of shares to hold for a rise is favored in

And what of the economic conditions? All the mines are near existing railways, and will be linked with them in due course. The completion of the Benguela railroad will lessen the cost of transport to Europe. In this respect the new copper mines are fortunate. Money and technology are available as never before in the history of mining. The work of constructing mills and smelters ought to be done quickly and efficiently. Climatic conditions are not ideal, but they are not bad, and if the American engineers honor the Eighteenth Amendment, when legally not bounden to do so, they will conserve their health, as many of their predecessors in Central Africa have, unfortunately, failed lamentably to do.

The mines themselves are not wet; artesian water is obtained in some of the boreholes; the Roan pumps yield only 200 gal. per minute. Coal and coke of good quality come from Wankie, in Southern Rhodesia, a distance of 500 miles. Wood and timber are plentiful. The remaining factor to consider is the most critical of all: labor. From what I heard in Rhodesia and Katanga four years ago, I would be inclined to look upon a possible scarcity of labor as a menace to the consummation of the great plans now being prepared for these wonderful copper mines, but Mr. Beatty and his engineers assure me that they have no fear on this score. It is anticipated that five years hence 2,500 white people and at least 15,000 native Africans will be employed. Obviously, what is needed is to bring the negroes within the range of civilization, which means the creation of necessities, an improved state of living, and a consequent urge to buy things not now required, so that the native will have to work to be able to purchase them. Next, it will be wise to protect the native workers from epidemics, such as are introduced among aborigines by invaders from Europe, and so prevent the mines from becoming unpopular.

English engineers say that the Americans, although they made a good record as technicians on the Rand, showed little skill in managing the natives and in looking after them. If the criticism is merited, it is

well to keep it in mind at this time and by so doing avoid the repetition of an unnecessary blunder.

American holdings in these African copper enterprises are large, and they are increasing. It is estimated that at least 30 per cent of the stock of the Roan Antelope is now in American possession, and nearly as much of the Rhodesian Selection Trust, together with 10 to 15 per cent of the Congo Border, N'Changa, and Bwana. The American Smelting & Refining Company, in February last, made a proposal for financing the N'Changa; and the negotiations were actually concluded, Mr. H. A. Guess becoming a director. Later such a violent protest was made by the shareholders against the arrangement that it was canceled, but not before Mr. Guess and Sir Edmund Davis exchanged compliments in vigorous style. Since then the Congo Border Concession has taken charge of the financing of the N'Changa, the participants being numerous, notably the Newmont, the Rio Tinto (Rothschild group), the Johannesburg Consolidated (Barnato group), and the Anglo-American Corporation, the last representing the Morgan-Grenfell group.

Here it may be apropos to say that the three leading men in mining finance in London today are Mr. Beatty, Sir Ernest Oppenheimer, and Sir Auckland Geddes—a remarkable trio. Sir Ernest has had an extensive and highly successful career in South African mining, including the Rand and the diamond fields; Sir Auckland, after being a college administrator and an ambassador, is now chairman of the Rio Tinto Company, which he has vitalized by his executive ability and business acumen. Mr. Beatty is quite as sagacious in finance as the other two gentlemen are, and he has a great advantage over both of them in being a mining engineer, by training (at the Columbia School of Mines) and by wide experience. He has made a splendid position for himself in the City, and apparently has done so without arousing antagonism, although typically American in his methods.

In conclusion I may advert to the fact, to which I have alluded previously, that much of the direction and control of mines in London remains in the hands of men possessing little experience in mining operations. Our American mining companies not only engage the best professional talent freely, but they place engineers in the highest executive positions, so that many of my friends are the presidents of the mining companies for which they have in times past acted as resident managers or consulting engineers. In this obviously sensible custom we shall find one reason for the better management of our mines as compared with those that are handicapped by the interference, rather than the aid, of incompetent laymen. Titled gentlemen are still in demand in London as directors, and the ignoble scions of noble houses still shed the phosphorescent lustre of a decaying name upon the pages of a prospectus. The British shareholder has lost much money by his hankering for the feudal tradition.

Copper Output of Canada Increases 45 Per Cent in 1928

FINALLY revised statistics of the output of copper in Canada, as reported by the Dominion Bureau of Statistics at Ottawa, show a production in 1928 of 202,696,046 lb., valued at $28,598,249, compared with 140,147,440 lb., valued at $17,195,487, in 1927. This was an increase of 45 per cent in quantity and 66 per cent in value and marked the attainment of the largest output ever recorded for the Dominion. In 1928 Canada was the world's fourth largest copper-producing country, being surpassed only by the United States, Chile, and Africa.

Increases in production were noted in all copper-producing provinces, and much development work was carried on in Manitoba, where large copper deposits are being rapidly brought to the production stage. Horne Copper was the principal producer in Quebec; International and Mond Nickel were responsible for practically all of Ontario's output; Granby Consolidated, which operates mines at Hidden Creek and Copper Mountain, B. C., and Britannia Mining & Smelting, operating the Britannia mine, on Howe Sound, produced the larger part of the output from British Columbia. A small amount of copper is contained in the silver-lead ores exported from the Yukon Territory. Blister copper was made by Granby Consolidated at Anyox, B. C.; by Consolidated Mining & Smelting Co. at Trail, B. C., where it was also refined; at Port Colborne, Ont., by International Nickel; and at Noranda, Que., by Horne Copper. Ores from the Britannia mine, in British Columbia, and the Eustis, in Quebec, were exported to the United States for treatment. Ores from Copper Mountain were smelted at Trail, B. C., during the first part of 1928 and at Tacoma, Wash., during the latter part of the year.

Output of Iron Ore in United States Shows Slight Increase

IRON ore mined in the United States in 1928 amounted to 62,197,088 gross tons, an increase of less than 1 per cent, compared with 1927, according to the U. S. Bureau of Mines. Compared with the average for the preceding five years, however, the production in 1928 is smaller by about 1 per cent. Shipments of iron ore in 1928 amounted to 63,432,826 gross tons, valued at $155,788,657, an increase of 3.6 per cent in quantity and of 3.1 per cent in total value compared with the record for 1927. The average value per ton of iron ore at the mines in 1928 was nearly $2.46, as compared with $2.47 in 1927. Stocks of iron ore at the mines at the end of 1928 amounted to 9,177,896 gross tons, a decrease of 9 per cent. In the following table is listed in gross tons the iron ore (exclusive of ore containing 5 per cent or more of manganese) mined in the various states in 1927 and 1928:

State	1927	1928
Alabama	6,445,464	6,307,844
Colorado	32,206	52,713
Georgia	50,312	73,052
Michigan	15,075,079	13,676,984
Minnesota	35,461,138	37,564,005
Missouri	78,605	94,899
Montana	2,837	1,640
New Jersey	220,660	250,332
New Mexico	214,747	184,623
New York	853,159	712,757
North Carolina	32,528	.....
Pennsylvania	1,170,435	1,023,870
Tennessee	121,914	128,928
Utah	222,879	320,655
Virginia	64,592	27,902
Washington	550	1,012
Wisconsin	1,091,118	1,284,592
Wyoming	602,877	491,280
Totals	61,741,100	62,197,088

How to construct a

Discarded Steel Cable Serves Useful Purpose. Features of Lightness, Cheapness, and Strength Make Design Attractive for Wide Adoption.

Flume line crossing difficult ground

DISPOSAL of tailing from the new 300-ton mill of Verde Central Mines offered many opportunities for the spectacular, as well as the usual amount of engineering difficulty. The tailing is carried in a flume 12,211 ft. long, of which length 1,300 ft. was built in a box canyon along the face of a cliff. To transport supplies for construction to the site in the canyon, two 500-ft. cable and trolley spans were erected across the canyon. These structures were in addition to the suspension bridges carrying the flume, the first of which was a span of 126 ft. and the second 150 ft.

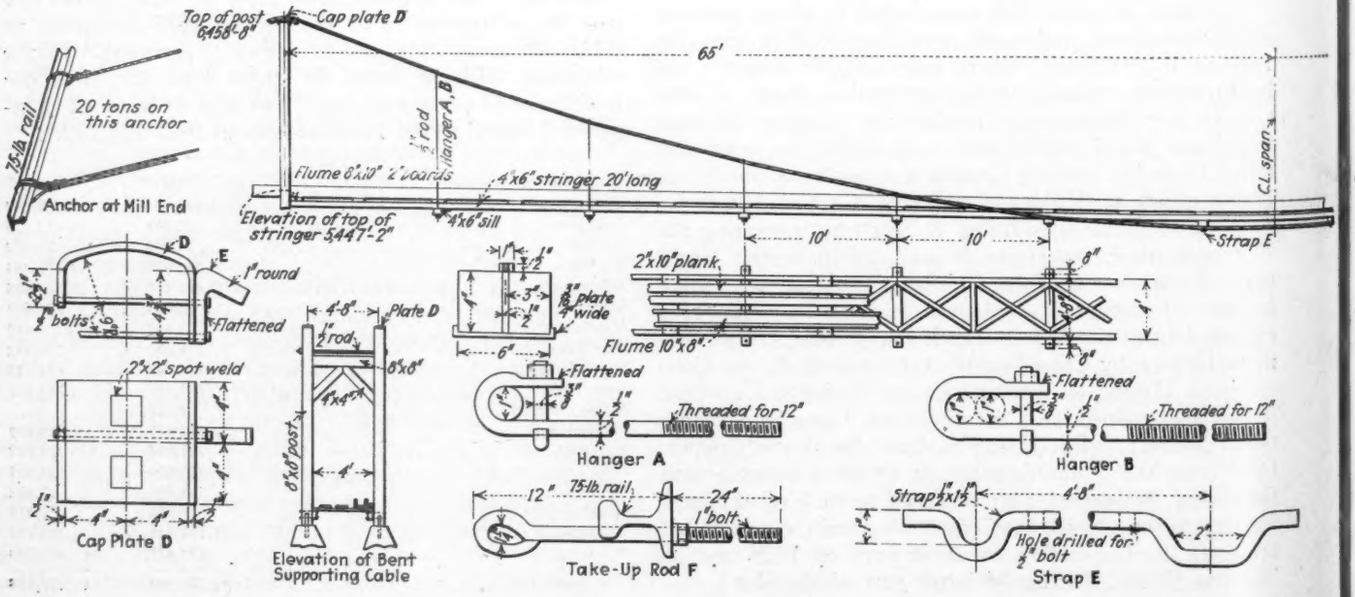
Many qualms are experienced by the average engineer when the designing of a suspension bridge is mentioned. Visions of tables of catenary functions, long formulas, and considerable cut and try arise. A detailed description of the method used in designing the bridges for the Verde Central may therefore be helpful, particularly as a light and cheap bridge is frequently required, for which conditions this type will serve adequately.

The following formula, taken from Merriman's "Handbook for Civil Engineers," was used to determine the curve and length of hanging bolts. It applies to an equally loaded span and was apparently derived from the equation of the parabola:

$$y = \frac{4hx^2}{l^2}$$

h is the total depth of curve from the top of the projection of the post to the elevation of the cable at the center of the span; x is the distance from the center of the span to the hanger; l is the span; y is the height of the curve above the elevation of the center of the span at x.

The length of post being limited by timber stocks at the mine, the altitude or depth of curve was also thus limited. In bridge No. 2, a depth of 15 ft. and a load of 75 lb. per linear foot were used. The span figured approximately 150 ft. In reality it was 155 ft., but the extra distance caused no material error in the final calculation. The value of y in terms of x was equal to $0.00266x^2$, and the curve was plotted easily, following the calculation of values of y for assumed values of x. The base line used in plotting is perpendicular to the axis of the curve or h, and this axis may be rotated to conform to any given



a suspension-bridge tailing flume

By Leon W. Dupuy
Chief Engineer, Verde Central Mines, Inc.

grade for flume without changing the value of x or y with respect to the curve. The grade affects merely the elevations of the tops of the posts, supporting the cable, and the elevation of the flume line in reference to the horizontal datum plane. Maximum tension was then determined by the following formula, also taken from Merriman's handbook:

$$T = \frac{w}{8h}\sqrt{l^4 + 16h^2l^2}$$

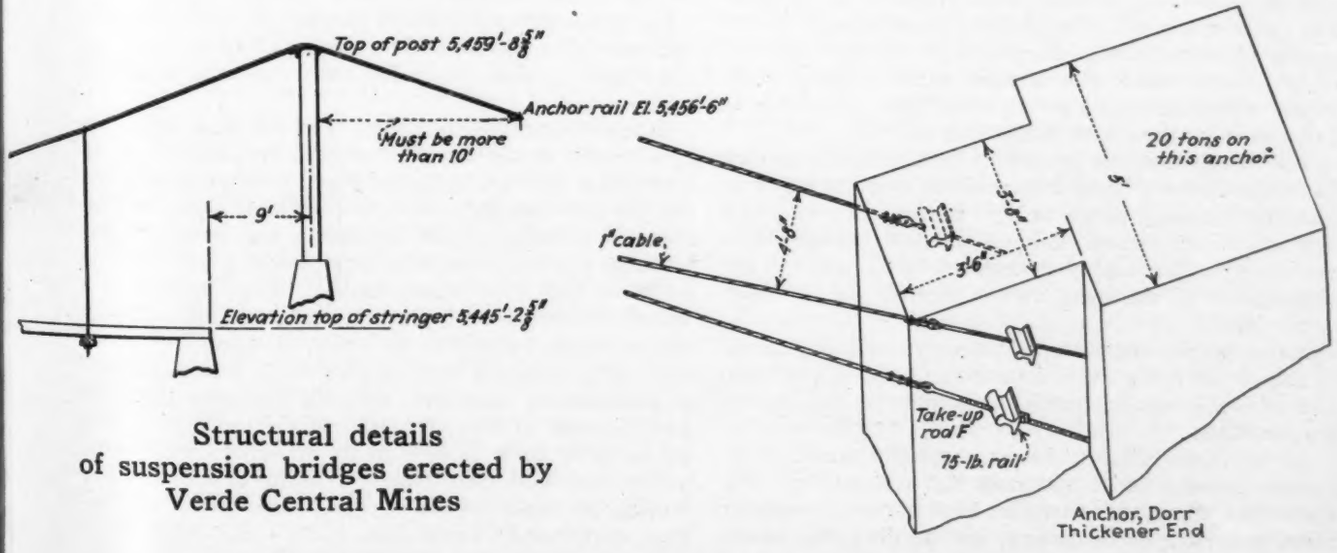
or, $T = \frac{75}{8 \times 15}\sqrt{150^4 + 16 \times 15^2 \times 150^2} = 15{,}146$ lb.

Considerable second-hand 1-in. cable was available and was adequate for the construction of both bridges. On bridge No. 1, x and y distances were checked with surveying instruments and found to be exceptionally close to the calculated values, proving that the formula is satisfactorily accurate for light, short spans. For construction purposes, allowances for threads were liberally made, perhaps in excess of necessity. The unequal loading during construction on such a light type of bridge as this caused some difficulties which were ironed out as an even and full load was gradually assumed. Some slight variations may occur, owing to unintentional unequal loading affecting the values of y in the final adjustment of a bridge. These are amply taken care of in threads on hanging bolts. A lower

Suspension bridge No. 1

center of gravity might be advisable where higher piers are possible. Such a condition is easily taken care of by a uniform addition to the value of y at each bolt length throughout the entire bridge. The centers of gravity on Verde Central bridges are somewhat high, but so far they have proved to be stable structures. The plank flooring or walkway is an important item in stabilizing the mass.

On bridge No. 1, a return water line from the tailing thickener was added. This line was constructed of wood pipe and suspended below the bridge. A grade of 0.25 per cent was maintained, necessitating a fine adjustment of hanging rods. To carry the extra weight



Structural details of suspension bridges erected by Verde Central Mines

two cables twisted about each other approximately three turns in ten feet, were placed on one side. The bridges were originally designed to carry a box flume, but wood pipe was found to serve the purpose better. A grade of 2 per cent or more was maintained throughout the flume line. This grade was too slight to use all the available drop between the mill and the tailing dam, so drop boxes and "hogslides" were installed at several points. The "hogslides" were lined on the bottom with a 2-in. layer of cement to prolong their life. A number of short slides are grouped near the Calumet & Jerome property, but, approaching the Gadsen tract, the side hill becomes steep, and here a slide 595 ft. in length and on a 60 per cent grade was installed.

The tailing is finally discharged at a dam near the old Gadsen shaft. This dam is of the usual type found in the Southwest and has an earthen core, against which the sand settles out. Eventually a high dam will be built by gradually elevating the crest of the dam by hand shoveling of the sand. Clear water is discharged through an overflow box placed at the upstream end of the pond caused by the dam.

Many Potentially Important Metals Are Unknown or Undeveloped

OF THE ninety known elements, seventy are metals. They range in plentifulness from aluminum and iron, which make up about 8 per cent and 5 per cent, respectively, of the crust of the earth, to rhenium, masurium, and illinium, which escaped notice until 1924, and probably are present in the earth's crust to a total of less than one part in a million million.

Widely distributed metals such as gold, silver, iron, copper, mercury, lead, and tin have been known since prehistoric times. Radium, polonium, and actinium were not discovered until 1898, in spite of their remarkable property of radioactivity, which makes it possible to detect them with an electroscope when they are present in traces much too small to be recognized by chemical methods. Ytterbium, lutecium, protoactinium, hafnium, and three other metals, named above, have been discovered since 1907.

The most recent additions to the list of metals, and, indeed, many rare metals discovered long ago, have not been obtained except in combination with other elements. Their properties in the metallic state are completely unknown except in so far as they may be inferred from those of better-known elements which are related to them chemically. Even more plentiful metals—barium, strontium, and the rare-earth metals—and several of them really not very rare—such as cerium, lanthanum, and yttrium—have only recently been prepared in a reasonably pure condition. The striking improvement in the quality of copper that is effected by the removal of traces of impurities makes one wonder whether many other metals would not disclose important new properties if they were purified with great care.

The metals differ in properties quite as much as they do in abundance. Tungsten is almost twice as heavy as lead, but lithium is nearly as light as cork. Mercury is a liquid; sodium, lithium, indium, and thallium are much more fusible than lead; but tungsten barely melts at the temperature of the most intense electric arc, at about 6,150 deg. F.

Many metals catch fire and burn if merely exposed to the air in finely divided condition. Gold, platinum, and others, however, remain unoxidized at the highest temperatures.

An occasional alloy possesses properties nearly intermediate between those of metals that compose it. The gold-silver alloys, for example, have about the melting point, color, hardness, density, and ductility that would be expected from their proportion of gold. Yet this is unusual. The common experience is that when metals are alloyed together, two and two do not make four. We are more likely to get some weird result, as one-fourth, or a million. Most alloys, for example, melt at temperatures very different from those of the elements that compose them. Alloys with unexpected new properties in machinability, electrical conductivity, magnetic permeability, resistance to corrosion, hardness, ductility, and tensile strength are continually being discovered by research.

Since the properties of alloys are often determined by ingredients that are present in them in insignificant amounts, even the most obscure and rare elements have a good chance of proving useful. Seventy different metals are available. Many of them are comparatively unknown only because no uses are known for them. They are really more plentiful than gold, silver, platinum, or mercury. Titanium, barium, manganese, and chromium are indeed far more abundant than most of the familiar heavy metals, such as lead, copper, and zinc. The light metals, calcium, sodium, potassium, and magnesium, are more plentiful still, and together make up over 11 per cent of the crust of the earth.

With so many metals to choose from, endless combinations are possible. As metals that are now unfamiliar become better known or are more carefully purified, who knows what new applications may appear? A new zinc-cadmium alloy promises to become an excellent substitute for solder. Aluminum-coated sheet iron cans have been made.

The usefulness of the metals does not cease with their applications in the metallic state, individually or as alloys. New uses are being developed for their oxides and for the salts that they form by combining with the non-metals. Titanium oxide is coming into more general use as a paint pigment, and may presently win favor in white enamels. Zirconium oxide is being exploited as a substitute for tin oxide, in the ceramic industry. Magnesium oxide, formed by the action of steam on films of magnesium metal, is being applied in an interesting way as an electrical insulator. And the discovery that milk contains salts of fourteen different metals suggests that we ought to know more than we do about the effect on human health of mere traces of compounds of the less familiar elements present in our food.—*Industrial Bulletin* of Arthur D. Little, Inc.

California's Franchise Tax Law

and the

Mining Industry

By J. S. WALLACE
San Francisco, Calif.

THE franchise tax law now in force in California is one of the products of a commission appointed by the legislature of that state in 1927 for the purpose of reforming a tax procedure which had been "weighed in the balance and found wanting." The framers of the new law have carried on their work in a painstaking fashion and have, wherever possible, profited by the experience of other states, but they have not been entirely successful in steering clear of legal defects, inasmuch as the U. S. Supreme Court, by an opinion just rendered in the suit of Macallan Company *vs.* Massachusetts, has made it necessary for the California authorities to eliminate income from tax-exempt securities when measuring the franchise tax to be paid by corporations. However, as this is the only legal defect which has appeared above the surface up to this time, and as the various states affected by the ruling have joined in the effort now being made to obtain a rehearing of the case, it is possible that the law will remain on the statute books in its present form, or as modified by the Macallan decision, for some time.

Each tax-paying corporation is permitted by the new law to fix, tentatively at least, its own franchise tax, year by year, by means of a formula which, as far as appearances go, can be easily applied. A gross tax of 4 per cent is placed on the net profits derived from the business transacted within the state itself, which tax may be reduced to a point not in excess of 75 per cent, by offsets consisting of 100 per cent of the personal property taxes, and 10 per cent of the real-estate taxes paid in California by the corporation. This self-taxfixing feature, although tentative in character—inasmuch as the "returns" submitted are subject to audit by the state authorities—meets with general approval. Formerly a taxpaying corporation could not determine, even approximately, what its franchise tax would amount to until it had received a formal notification from the state authorities, and when this notification came the taxpayer was in entire ignorance as to how the figures it contained had been reached. The new law, by establishing a definite formula for calculating the tax, applicable directly to net profits as shown by the taxpayer's books, furnishes a striking contrast to the old law which, *inter alia,* levied a franchise tax on the basis of capital invested by the taxpayer—actually, or constructively, within the State of California.

As far as corporations operating metal mines in California are concerned, no good reason exists for believing that the new tax law will be harmful to them. Indeed, the returns submitted for the current year will probably show a lessened tax total as compared with the total sum that would have been payable under the old law, because the personal and real-estate taxes payable by the corporations were computed on the same basis under each law. Moreover, the new law substitutes actual profits as the basis for assessing the franchise tax for the capital-invested method formerly employed. Few mining corporations operating in California are making large profits for their owners. Consequently, only few of them will be under an obligation to pay anything beyond the minimum sum of $25 as a franchise tax, even if there is a failure to take full advantage of the depletion privilege conferred by the new law.

Although the depletion privilege contained in the new law (which follows the federal income-tax law procedure, save that the depletion can be taken on the basis of a valuation as of Jan. 1, 1928) will in most instances be ineffective in reducing the taxes of the metal-mining corporations, it should prove highly beneficial to the oil producers of the state. This is explained by the fact that formerly the State Board of Equalization—when dealing with oil companies—indirectly, but effectively, utilized the earnings of the corporation as a factor in establishing a capital basis for the tax, and failed to give any credit for depletion. Therefore, almost everything the oil companies can set up as depletion will serve to reduce their franchise taxes from a comparative standpoint. Subsidiary corporations that have been paying their franchise taxes on the old capital-invested basis, and have been turning their products over to their parent corporations at cost, or less, will pay little or nothing under the new law. However, if the parent companies have a business status in California, the latter will automatically make good the loss in tax revenue attributable to the procedure in question, because the franchise tax will reach their own increased earnings. Cement corporations will doubtless be benefited by the operation of the new law, inasmuch as their taxes are likely to be favorably affected by the depletion factor it contains.

It must not be assumed from the foregoing that the Tax Commissioners took a "leap in the dark." On the contrary, they proceeded rather cautiously, having been charged with the duty of fixing a franchise tax plan

which would serve to reduce the rate paid by the banks without reducing the total yield of the tax when applied to all corporations subject to it. They obtained a foundation for their work by means of a questionnaire to 2,097 corporations, selected from a total of about 25,000 corporations which paid state franchise taxes in 1927. These included all the large corporations in California and a random selection of the small corporations in each group. The questionnaire was designed to elicit information to determine the relationship then existing between taxes and net income.

Of the 602 mining companies that paid the franchise taxes, 78 were furnished with the questionnaire. Comprehensive replies were received from 50. The remainder were returned incomplete, or failed to receive attention because of non-operation of the mines. Of the operating mines, nineteen showed a loss and only twelve a net income. The total net income of these companies for 1927 was reported to be about $2,500,000, whereas the franchise tax paid by them in 1928, plus personal property taxes for 1927, amounted to about $80,000, equal to an earnings tax of 3.2 per cent. Of the twelve companies reporting a profit, the average percentage of taxes to income was 2, although the percentage of taxes paid individually by these corporations ranged from 1.2 to 12.7. The franchise tax standing alone represented only 0.8 per cent in relationship to net income.

Of the 107 questionnaires sent to the oil companies selected from the 827 which had paid the franchise tax in 1927, 78 complete replies were received. Of these, 18 showed an operating loss and 59 a net income. The net income of the 77 operating companies in that year amounted to about $62,250,000, against which franchise (1928) and personal property (1927) taxes were paid, amounting to a little over $4,000,000 with a tax relationship to net income of 6.7 per cent. One oil company paid franchise and personal property taxes which combined amounted to less than 0.01 per cent of its net income. Another company paid taxes amounting to more than fourteen times its net income. Still another, which sustained a considerable loss in this year, paid taxes of nearly $30,000.

Mining or smelting companies with offices in California, but with some or all of their operating properties in other states, are, of course, affected by the new law, inasmuch as they have to deal with some of the many questions involved in the definition of the term, "business transacted within the state." However, it is reasonable to assume that in the comparatively near future rules will be formulated governing these questions which will be accepted as reasonable by all parties concerned.

As almost all corporations subject to the franchise tax have forwarded their returns to the Tax Commissioner within the last few weeks, it is unlikely that the state authorities are in a position to determine at this time how the new law has affected the various business groupings. The individual taxpaying corporations already know whether they have gained or lost something as a result of the changed procedure, but the general public will have to await the formal announcement from the state capital ere it will know how matters stand.

The new law is much better than the old, and cannot be otherwise than beneficial in its general application. Most of the changes made in the incidence of the tax were needed badly.

Those who were brought into contact with the State Board of Equalization in the past as representatives of protesting clients, and who have tried to analyze the decisions rendered by that body in the light of facts presented at the hearings, have marveled that a reformation in franchise-tax procedure has been so long delayed. The bankers of California, whose protests started the movement which has just culminated in the enactment of the present law, had a real grievance, inasmuch as their taxes (which were assessed on share values) had a relationship to net income of 12 per cent in the case of state banks, and 11.4 per cent as against national banks. The unfairness of this is shown by the accompanying comparative table, which was built up from the data contained in the questionnaires received by the California Tax Commission in the course of its survey.

Relationship Between Former Franchise Tax and Net Income

Sample of 1,246 Business and Financial Corporations, Classified According to Character of Business

Kind of Corporation	"A" Number of Corporations Included	"B" Net Income for 1927 (a) (in Thousands)	"C" Franchise Tax for 1928 (in Thousands)	"D" Relationship of Tax to Net Income (b) (Percentage)
Investment and other finance	101	$49,965	$90	0.2
Building and loan	158	4,398	220	5.0
Real estate	95	12,984	90	0.7
Oil	77	59,097	809	1.4
Mining	32	2,474	20	0.8
Manufacturing	324	56,160	685	1.2
Mercantile	226	37,590	316	0.8
Agricultural	66	3,197	30	0.9
Water	29	3,783	48	1.3
Miscellaneous	138	12,351	119	1.0
Totals	1,246	$241,999	$2,427	1.0

(a) This differs from net income as reported to the federal tax authorities in the following respects: Dividends, tax-exempt interest and the California state franchise tax for 1927 have been added. Also, losses for preceding years have not been deducted. In the case of mining and oil companies, book depletion has been used in place of the depletion allowed on the federal returns. Where the business extends to several states, the California share has been allocated on the basis of gross receipts except in a few instances where the corporation has recommended and supplied some other basis of allocation.

(b) This figure is the ratio between the total franchise taxes paid by all the corporations in the sample and the total net income of those corporations in the sample operating at a profit.

Motor Truck and Caterpillar Haulage in Mining

PROOF that opportunity exists for the wider utilization of motor haulage in mining work is contained in an account of the pit operations of the United Verde Copper Company, at Jerome, Ariz., prepared by Mr. G. J. Young, associate editor, after a recent visit of inspection to the property. Scrapers are mounted on modified truck bodies; electric shovels are made more mobile by the easy movement of gasoline-motor traction and caterpillar treads, the latter being also used for ore trucks specially designed for wet-weather service. A tool truck, equipped with an oxy-acetylene welding outfit, is ready for any emergency. The conduct of mining operations in a persistent fire zone, and the means adopted to overcome hazard, are also features of a description that forces attention to the speed of change in ideas, equipment, and practice in a progressive mining community. The account will appear soon.

COMMENT AND CRITICISM

Graphic Comparison of Flotation Results

Director of Research of United Verde Copper Describes and Illustrates an Efficient and Informative Method

To the Editor of "E.&M.J.":

As long as the flotation process develops as actively as it has during the last fifteen years, comparison of the results of testing ores under various conditions is necessary. Various indexes have been advocated for expressing excellence of flotation results, but each has its shortcomings. A graphic method of

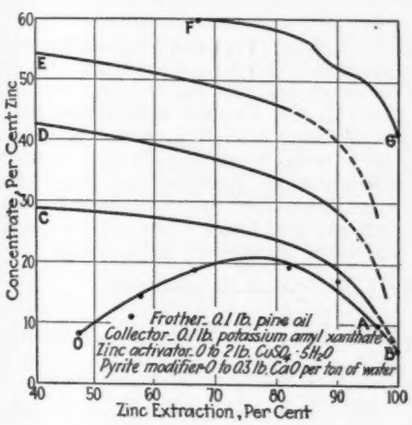


Fig. 1—Curves for a zinc ore

comparison is herewith presented, as it has proved quite convenient and valuable in the study of the flotation concentrate of the various ores from Jerome, Ariz.

The method consists of plotting the grade of concentrate produced against the percentage of extraction of the desired mineral. In Fig. 1 are given typical curves from plotting of results obtained on a zinc ore.

The ore in question was a heavy pyritic ore containing 5.6 per cent zinc as marmatite, pure pieces of which analyzed 60 per cent zinc. Curve *OA* represents rougher tests on this ore, in which increasing amounts of copper sulphate were used as activator for the flotation of marmatite, and also the amount of lime used was varied in order to help increase extraction and raise the grade. A few of the points used in determining the curve are plotted to show usual variations from the average curve. When satisfactory flotation conditions are finally obtained, a rougher concentrate containing slightly over 20 per cent zinc and permitting an 80 per cent extraction was possible. No further activation by copper sulphate, nor alteration in alkalinity of the pulp, owing to the presence of lime, could increase extraction without decreasing the grade of the concentrate. Extraction could be increased indefinitely by accepting a lower grade of concentrate, and in the flotation testing the curve is traced as far as the point *A*. The limitations of a rougher test are such that to obtain 100 per cent extraction all of the ore must be floated, and therefore the curve has been continued in dotted form to the point *B*, which represents the total of the original ore.

If satisfactory conditions for roughing tests are obtained, such that a portion of the curve, like point *A*, is realized, manipulation of the flotation machine will permit increasing the grade of the rougher concentrate at the expense of extraction, and, as grade is indefinitely increased, the curve *BC* is developed. In other words, while one holds mechanical conditions of operation of the flotation test machine constant, and varies the amounts and proportions of one or more flotation reagents, the curve *OA* will be realized. Then, while a chosen set of good reagent conditions is held constant, as determined by the curve *OA*, the mechanical conditions of operation of the roughing test are altered successively to produce higher-grade froths, with consequent losses of extraction, and curve *BC* will be traced. Points, of course, can be obtained intermediate between the two curves by intermediate choice of the variable conditions. Also, points can be obtained in the area under curve *OA* in the same manner.

The curve marked *D* represents tests in which the rougher froth was cleaned in a cleaning cell, and for brevity it will be called "the roughing and cleaning curve." At its right end it should stop at point *B*, again for the reason that to obtain 100 per cent perfection in extraction it is necessary to take all of the ore into the cleaned concentrate.

If the cleaned concentrate is recleaned, a curve such as that marked *E* in Fig. 1 is obtained, and its right end should likewise be at point *B*. This curve can be called "the roughing, cleaning, and recleaning curve." Further re-treatment of the flotation concentrate will cause it to rise indefinitely in grade until an ideal curve is approached, beyond which it is impossible to go. This ideal curve is sketched between points *F* and *G*.

The ideal curve *FG* represents the imperfection in grinding. If all of the marmatite in the mineral were liberated by grinding, the ideal curve would be horizontal at 60 per cent zinc in the concentrate, which is the top of the diagram. If the grinding, however, is such that only 68 per cent of the marmatite is ground free, the left end of the ideal curve will fall at this point *F*, and as middling grains of increased foreign mineral content are added to the ideal concentrate, its analysis will fall below 60 per cent, but, of course, the extraction of zinc will rise, until at some point, *G*, all of the zinc is included in the ideal concentrate and there will be discarded that portion of the other minerals which is free of zinc. Each different grind of an ore will give a different ideal concentrate curve.

To sketch an ideal concentrate curve for a definite grind is a difficult matter, which involves segregation of a sample of the ground ore into fractions by all known means, such as fractionation by a series of heavy liquids, analyzing the floats on liquids of different specific gravity, and supplementing this by microscopic examination, to assure knowledge of the condition of unlocking of each gravity fraction. Screen and chemical analyses of the various fractions are also desirable, and, for ground ores, the finer sizes must be elutriated instead of screened. For microscopic examination of finely

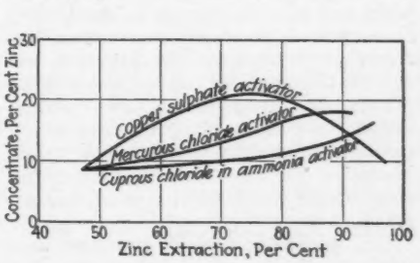


Fig. 2—Rougher curves

ground material it is necessary to briquette it in a binder like stiff wax or bakelite and prepare a polished surface for microscopic examination. A discussion of the theoretical shape of this curve is soon to be published by a co-worker, M. Slavin.

The use of the ideal curve is mainly a convenience in approximating the degree of perfection of the flotation operation within the limits permitted by the grind. This ideal curve need not be known.

The investigation of new flotation reagents or conditions is most rapidly car-

ried out by rougher tests alone, and therefore the lower portion of Fig. 1 is of greater interest. In Fig. 2 are given three rougher curves for different flotation activators. The upper is the copper sulphate curve of Fig. 1 for increasing amounts of copper sulphate; the next is for mercurous chloride; and the lower for a solution of cuprous chloride in ammonia.

It will readily be seen that in the important area of the diagram—namely, that in which high extraction is obtained—both mercurous chloride and cuprous chloride dissolved in ammonia permit higher grades of concentrate; whereas, in all other portions of the diagram they are both inferior to the copper sulphate. To express these facts in tables of figures or by the use of arbitrary indexes is difficult, whereas the graphic method of comparison is less affected by the omission of important data. Of course, observations on the working quality of a froth, its tendency to be voluminous or scant, heavily or lightly loaded, must be separately reported. However, for quickly picking the conditions under which the best metallurgical results might be obtained, the graphical method has proved exceedingly useful.

OLIVER C. RALSTON.

Clarkdale, Ariz.

New Seismic Method Said to Parallel Current Practice

To the Editor of "E.&M.J.":

"Modern Instruments for Seismic Prospecting," by Dr. Ambronn, in *Engineering and Mining Journal* of July 20, 1929, pp. 93-99, is misleading in several particulars, as the extensive development of the seismic method in the United States during the past four years and present practice in the United States have been wholly overlooked. Dr. Ambronn recognizes the previous use only of the so-called mechanical seismographs, and proposes a "new" method making use of an electric seismograph registering the curve of acceleration, instead of the curve of vibration registered by the mechanical type of seismograph.

Dr. Ambronn's "new" method parallels closely the most extensively used method in the United States, a method which has been in general practical use in the United States for four years, and which has to its credit the discovery of over ten salt domes that have been definitely proved by drilling and four of which have shown oil in the first well drilled, and as many salt domes again which have not been drilled. This method makes use of an induction type seismograph that registers the curve of acceleration; of amplification of practically any amount at the will of the observer by rotating a dial; of automatic registration by oscillographs, one to five seismographs recording on the same film; and it has anticipated essentially all the "new" features of Dr. Ambronn's method. His emphasis on the very much lower charges of dynamite required by his "new" electric seismograph again parallels history in the United States in that the inexperienced introducer of a new type of electric seismograph invariably stresses the superior sensitivity of his instrument and the small charges of dynamite that are required in its application.

The "normal" ground unrest of the observatory seismologists of four to six cycles per second, as Dr. Ambronn states, will not obscure a record of the curve of acceleration. But the situation in the oil-field area of United States, at the least, is that a "micro" unrest of very short period is commonly present and puts a definite maximum limit on the usable amplification and a definite minimum limit on the charge of dynamite, even with electric seismographs registering the curve of acceleration. The history in this country is that an experienced seismograph observer does not try to see how much he can reduce his charge or how much he can stretch his amplification, but steps down his amplification until the ground unrest is smoothed out and steps up his charge of dynamite so that the earth waves come in with a sharp decisive kick.

An inexperienced introducer of a new type seismograph, however, frequently obtains an unwarrantedly favorable opinion of the working sensitivity of his instrument and the smallness of the dynamite charge required, if his experimental work and tests happen to have been done in an especially favorable terrain. One company, for example, did its test field work in the area of the Beaumont clay, in a terrain especially favorable to the transmission of energy of the explosion by the earthwaves; stressing the sensitivity of the instruments and the economy of dynamite, the company came to the conclusion, similarly as Dr. Ambronn has, that only small charges, of 10 to 20 lb. of dynamite, were needed on three- to four-mile "shots." The company's experience soon was that in the Lissie sand area charges of 250 lb. were necessary on the same length shots; that even in especially favorable terrains low charges, such as 10 to 20 lb., allow no factor of safety; that with those low charges many "shots" have to be repeated; and that on the seismograms of many other "shots" there is considerable uncertainty in regard to the exact point of impact of the waves. The company now uses 40 to 75 lb. of dynamite in places where in its inexperienced days it would have attempted to use only 10 to 25 lb.

These comments apply only to the "refraction" type of shooting. In the "reflection" type, very much smaller charges are used than in refraction shooting.

DONALD C. BARTON,
Consulting Geologist and Geophysicist.

Houston, Tex.

Consultation

Make It Plural

Despite the dictionaries, much current speech and writing appear to me to warrant the use of the word "data" as a singular noun—expressing one idea. I note, however, that "Engineering and Mining Journal" treats the word as the plural of "datum," which word appears so seldom as to be entirely unfamiliar to the non-technical listener and reader, even though it is given as the singular of "data" by the lexicographers. Should not usage, rather than the rules of precise etymology and grammar, govern in this matter?

Perhaps in the vernacular of the non-technical elements of industry, and in so-called popular writing and shop talk, "data" may eventually come to be used as a singular noun, but we doubt that precise and painstaking technical writers will so use—or misuse—the word. Scientists and professional men and women have no excuse for attempting to "write down" to win the approval or cater to the limited understanding of the illiterate or half literate. No question of pedantry or puristic literary pose enters into the preference of those who select, invariably, the correct usage. All such say and write "data are" because that form is authentic and correct.

Who Has Domestic Corundum to Offer in Carload Lots?

"We are interested in sources of natural corundum reasonably low in iron content. If you can suggest any sources for this product, we shall very much appreciate your doing so. If our tests of any such material available are satisfactory, we shall wish to purchase the corundum in carload lots, provided we can be assured of uniformity in successive cars."

If any one able to supply corundum under the aforesaid conditions will write *Engineering and Mining Journal* to this effect, such information will be forwarded to the company from which the inquiry was received.

Mining Stannite

"I am interested to know if stannite, an ore of tin, is being mined at any place at the present time."

Stannite, a tin-copper-iron sulphide, also generally containing zinc, is the principal tin mineral being mined in western England. The Cornish tin industry, however, has declined in recent years, mainly because of the increased cost of deep-level mining. The output from the county in 1928 was about 2,000 tons.

Personal Notes

Frank L. Sizer, consulting mining engineer, of San Francisco, is in New York this week.

C. J. Kelley, president of Anaconda Copper Mining, is taking a vacation at Kalispell, Mont.

E. G. Deutman, superintendent of the Zinc Separating Company, was a visitor in New York this week.

C. O. Anderson, metallurgical engineer of the Century Zinc Company, was in New York this week on business.

C. W. Lerchen, of Idaho Springs, Colo., has been elected president of the Clear Creek Metal Mining Association.

George A. Easley, of Mineral Research Corporation, recently left New York for Europe. He expects to be away several months.

H. Donn Keresy, president of the Anaconda Wire & Cable Company, is spending the rest of the summer in Montana.

John A. Burgess, formerly of San Francisco, is now engineer for Mayflower Associates, Inc., with offices in New York.

F. A. Weymouth has been named chief metallurgist for the Colorado Fuel and Iron Company, filling the place of **Jacob Cambier,** retired.

Edward Mosehauer, in charge of Anaconda copper sales, will return to New York Monday after several weeks spent in England.

W. E. Segsworth, consulting engineer for Amulet Gold Mines, recently paid a visit to the company's properties in the Rouyn district of Quebec.

H. D. Miser and **J. B. Reeside, Jr.,** of the U. S. Geological Survey, left Washington late in July for field work in Colorado, New Mexico, and Utah.

George W. Tower, Jr., of Guggenheim Brothers, has just returned to New York City after a trip of inspection through the mining districts of Mexico.

S. G. Blaylock, general manager of Consolidated Mining & Smelting of Canada, has received a testimonial of appreciation, signed by 2,520 employees of the company.

Harry Granberg, of Oshkosh, Wis., is in the vicinity of Steamboat Springs, Colo., supervising the work of getting his Royal Flush property in condition for development work.

F. M. Connell, of Toronto, and **M. B. Huston,** of Philadelphia, members of the board of directors of Mandy Mines, Ltd., are inspecting the company's property in the Flin Flon district of Manitoba.

Charles M. Warner has returned to Herculaneum, Mo., where he is in charge of the St. Joseph Lead Company's smelter, after several months devoted to sales promotion work in electrolytic zinc.

George A. Kervin, of San Francisco, formerly manager of Mason Valley Mines, will occupy the same position at the Empire and North Star mines, at Grass Valley, Calif., now a part of Newmont Mining.

Dr. **H. C. Richards,** professor of geology and mineralogy at the University of Queensland, Australia, left Melbourne recently for Cape Town, where he will visit African gold and copper fields as

DR. H. C. RICHARDS

a member of a royal commission on the mining industry of Queensland. Professor Richards, as the official delegate of the Australian government, will also attend the International Geological Congress and the conference of the British Association for the Advancement of Science. He is a prominent figure in Australian mining, and has been associated with the university since 1910.

H. Aspoas, formerly designing engineer with the St. Louis Smelting & Refining Company in the Tri-State district, has accepted a position as sales engineer for the Ore Reclamation Company, of Cardin, Okla.

Arthur H. Hamilton has been made a director of Huronian Belt, which controls the Keeley, Vipond, and Cooper Gold properties in northern Ontario. He fills the vacancy caused by the recent resignation of **R. S. Dening.**

Carlton D. Hulin, associate professor of geology of the University of California, has been studying the geology of the copper deposits in the vicinity of Ely and Kimberly, Nev., for the Consolidated Coppermines Corporation.

Dr. **Henry Mace Payne,** consulting engineer of the American Mining Congress, represented that body at a meeting of the newly created Natural Resources Commission of South Carolina, which was held recently at Columbia.

Robert M. Davis, statistical editor of the McGraw-Hill Publishing Company, has been appointed chairman of a publicity committee, the purpose of which is to inform business men of facts concerning the coming national industrial census.

Ed. Bellah will be presented with the J. A. Holmes Safety Association medal by the U. S. Bureau of Mines, at the forthcoming Labor Day celebration at Bisbee, Ariz. Mr. Bellah won this recognition by his heroism at a mine fire at Gleason, Ariz.

R. L. Agassiz, of Boston, chairman of the board of directors of Calumet & Hecla Consolidated Copper, is visiting the properties of the company in the Michigan copper district. He was accompanied by **Robert Livermore** and **H. P. Cross,** also of Boston.

Charles R. Brazier, mining and newspaper man, has compiled a booklet of the mines in the Helena district of Montana, to commemorate the 65th anniversary of the finding of placer gold in Last Chance Gulch, upon which the business district of Helena is built.

C. Q. Schlereth, with Mrs. Schlereth, left Australia for London in June, after having spent five or six weeks in the Cloncurry district, Queensland, where he examined the mines of the Mount Elliott Company. Mr. Schlereth passed through New York on his outward journey last February.

Jacob Knight, who has been chief engineer at the Copper Queen smelter at Douglas, Ariz., for many years, was recently retired on a pension by the company. Mr. Knight was the first man to start an engine at the Douglas plant, to which he was transferred from the Bisbee smelter in 1904.

Charles Gordon, editor of the *Electric Railway Journal,* a McGraw-Hill publication, has been selected by the advisory council of the American Electric Railway Association for appointment to the office of managing director of that body, to succeed **Louis S. Storrs.** His appointment is subject to the approval of the executive committee of the association. He is expected to assume the duties of his new position on Sept. 1.

OBITUARY

James E. Pittman, known to his associates as the champion hard-rock driller, was killed by lightning at Silver Lake, Colo., recently. He was 61 years old.

Hugh Walsh, of Toronto, a pioneer in the Porcupine district of Ontario, died suddenly in Montreal on July 26. Mr. Walsh was head of the Walsh Gold Mine, and was engaged in his duties at the office at the time of his death.

Arthur J. Friedl, metallurgical engineer and member of the A.I.M.E., died in Los Angeles on July 9. He was in the employ of the Southwestern Engineering Corporation as assistant metallurgist, and had previously been chief geologist for the Roberts, Friedl & Patten Exploration & Development Company.

When the Operator Buys Lubricants

INVESTIGATION of the lubrication practice prevailing in the metal-mining industry is likely to perplex the investigator at the outset. He finds that a certain company is using Blank's No. 5 grease on its rock drills and will have no other. No. 5 grease appears to be thoroughly satisfactory—the machine men apparently won't be happy unless they have it. As greases go, it is quite expensive, and on this account is not popular with the purchasing agent, but the mine superintendent insists on getting it. After finding this brand equally well liked at other plants in the same section of the country (although a variety of makes of drills are used), the investigator is almost convinced that No. 5 grease is the only thing for rock drills. He is glad that he has uncovered at least one fundamental fact.

A Surprise

So at the next plant he ventures confidently "Using Blank's No. 5 on your drills, I suppose?" but to his surprise gets the emphatic response from the superintendent that he is not; that he wouldn't think of it; that he used to use grease but quit; that drill clearances are too small for anything like grease; that oil is the only thing for drills; that when he first took to oil, it was Pink's brand, which was pretty good; although, being intended primarily for lubricating hot wet steel, it made the machines drag a bit. So now he is using Blue's oil, which the oil company makes for marine use for sticking to the cold, wet propeller shafts of steamships. The investigator has to admit that this is a pretty good hunch—this using oil that will stick to cold wet steel—but he has not forgotten Blank's No. 5 altogether and does not know just what to think. Certainly, opinion and practice seem variable, and which is orthodox he has not gone far enough to say. So, on to the next mine, some hundreds of miles away. Here he finds straight castor oil was formerly used, but a change was made to Blank's No. 5 grease and then back to oil again, this time to a red engine oil, which is being used freely at the moment. By this time the investigator is ready for anything, even for molasses as a lubricant, and so is not surprised when he eventually finds that the operators in a large important district have long since turned their backs on petroleum products so far as drills are concerned and are getting perfectly good lubrication—so they say—with castor machine oil.

Perhaps lubrication practice affords a little more variety where rock drills are concerned than in the lubrication of machinery of other types. In general, though, the only answer to a question regarding its status is that it is variable. Why such variety? Certain fundamentals exist, observance of which should lead to uniformity of some degree. These take into account such matters as the ability of the lubricant to function under the temperature of the atmosphere and of the surfaces to be lubricated; to resist the pressure of the moving parts so as not to be squeezed out from between the contacting surfaces either during normal running or on sudden shock; to flow fast enough, but not too fast, at any given temperature; to adhere to the surface lubricated under the conditions of operations without slowing down the machine or lessening its efficiency; to lubricate without injuring the surface; and to leave no deposits that may build up and interfere with running.

John Finn, of Red Jacket, knows exactly what will keep a rock drill in the pink of condition.

Varied Needs

Obviously, conditions of temperature, pressure, and the like vary with the machine. No one lubricant could meet all the varying conditions encountered in practice. The universal lubricant does not exist any more than the universal remedy for human ailments. This will explain some of the variation that exists in practice. Other factors must be sought to explain the rest.

Ignorance plays its part. Some operators are giving the subject of lubrication little or no study. If they think of it at all, it is to reorder at intervals the same old oil and grease they possibly have been using for years, or perhaps to change to something else that costs less. They leave selection to the master mechanic, who may or may not be progressive. Here and there a superintendent will say that he realizes he ought to give the matter serious study, but he hasn't had the time. One such operator spent $13,000 for lubrication last year and feels that it is undoubtedly too much. On the other hand, the chief engineer of one large company that has pulled itself out of this rut says: "About two years ago we suddenly awoke to the fact that a lot of money was being wasted in lubricants and at that we weren't getting proper lubrication. We started to study the matter and are profiting by it today."

The Guiding Star

Dependence on the oil salesman is another factor—an important one in view of the widespread practice among mining companies of "hooking up" to some refinery, which supposedly furnishes them with lubrication brains as well as lubricants. Not that such a connection may not be profitable to the mining company. Where the refinery is well equipped with a research organization for studying lubrication problems, and the salesman is an engineer or at least is well versed in the technical aspects of lubrication, the mining company may be getting the best expert advice obtainable. A certain operator has had such a refinery connection for several years, and on one or two occasions has turned to a competing oil company, thinking he could better his results. On each occasion, however, he confesses he has lost money by the change.

There is a difference, however, in salesmen. Some are helpful; others are just salesmen. The latter do not always go unspotted. "When a new oil salesman drops in to see us," said one mill superintendent, "we take him down in the plant to see if he knows anything. If he doesn't we get rid of him as soon as we can."

Whether the oil salesman "knows his onions" or not, his work primarily is to sell oil and grease, and he will make every effort to put his products into a mining company's plant or mine. This, of course, contributes to the variety of practice noted.

Ignorance of lubricants and the technicalities of lubrication, coupled with the consequent almost complete dependence on the oil company's sales engineer, must sometimes place a mining company at a disadvantage in buying oils and greases. It indicates poor pur-

The importance of lubrication was discussed in the issue of July 6, 1929, on pages 20-21.

chasing strategy, and the mining company has only itself to blame if it is wasting money that might otherwise be saved. The worse part of such ignorance is that the company usually does not know whether it could do better or not. Comparison with another operator's unit costs are of little help unless conditions are similar.

Training the Expert

To remedy this weakness one operator—a coal mining company—has created the position of lubrication engineer. The job of the person filling it is to know everything about lubricants and lubrication that is worth knowing. Ideally, he must know as much about them as the oil sales engineer, and in addition must understand the local lubrication problems. Practically, this is perhaps too much to expect. Selection and control of distribution are nevertheless up to him.

The unit cost of lubrication on the monthly cost sheet, if such a record is kept, together with the cost of maintaining the equipment, will not necessarily be an index of the efficiency of such an employee, though it probably will prove so. Conceivably, a lubrication engineer might increase the unit cost of lubrication and yet make a net saving by cutting the cost of maintenance through better lubrication. Decreased cost of maintenance in any event will not be immediately apparent, but any lowering of the unit cost of lubrication will quickly show itself.

An Awakening

Most metal mining operators are devoting more attention to lubrication today than formerly. None of them, however, so far as known, has created the position of lubrication engineer as such. In some circumstances the mine or mill superintendent directly concerns himself with such matters; but unless he is unusually free as to his time, he can hardly give them much attention. So the duty generally devolves upon the master mechanic or his assistant. In one large plant where the practice of using oilers has not entirely disappeared, the master mechanic depends largely upon his head oiler to supervise lubrication. This practical arrangement nevertheless provides no one able to talk intelligently on lubricants with oil-company representatives. Incidentally, this company does not tie up to any one refinery, with the result that it gets advice, possibly conflicting at times, from several different quarters.

In an equally large, if not larger, organization an assistant of the chief engineer gives part of his time to studying lubrication. This is probably the closest and most practical approximation to the position of lubrication engineer that the average mining company of medium or larger size can attain, in view of the universal desire for economy and the need for keeping a staff as small as possible. The small company, with its small staff, is not in a position to use a lubrication engineer, although realization of the important part that lubrication plays will undoubtedly lead to better practice in many cases.

The purchasing agent turns down the super's request for more quality at a higher price.

On Getting Down to Selection

In selecting lubricants several individuals may be involved. Mine and mill superintendents, mechanical and electrical engineers, master mechanics, and shift bosses all may have a hand. One large company is divided into units, each with its own mine and mill superintendent. There is a certain supervision, and things are discussed from time to time in staff conferences, but any one of these executives is practically free to order any lubricant he may desire. At the small mine or plant the number concerned with selection will be reduced to two or three, who combine in themselves the functions above suggested. The purchasing agent, where there is one, plays a part, though often the only function he performs is to order supplies according to specifications decided upon by others. In many cases he exercises a decided influence in matters of price. Where an effort is being made to lower the cost of lubrication, however, technical considerations rather than price should prevail. A superintendent in the South wants to use a certain high-priced lubricant, thinking that with it he can lower his unit cost. The purchasing agent at this mine, however, happens to have considerable authority and refuses to permit it, thus preventing the superintendent from showing whether he is right or wrong.

Picking the Winners

The oil company salesman, or sales engineer, plays an important part today in the determination of what lubricants are to be used in mining. The practice previously referred to has sprung up throughout the United States, whereby a mining company that has a lubrication problem, or thinks its lubrication practice can be improved, calls in the representative of some oil company (or possibly several such representatives). The oil man thereupon goes into the mine, mill, and power plant, studies the conditions at each point where lubrication is required, and eventually reports, recommending certain lubricants. He may possibly suggest more than one lubricant for a certain kind of equipment, leaving it to the mining company to select that which it likes best after a trial.

If his report is convincing and his prices are not objectionable, the mining company commonly signs a contract for a year, under which it often purchases from this particular refinery all oils and greases used. This contract, generally speaking, amounts to little more than an option to buy during the year at a stated price, and leaves the mining company free to go elsewhere if dissatisfied. Sometimes, if the operation be large, more than one oil company gets the business. Where only one oil company is concerned, the agreement may continue year by year, or until, as one operator puts it, "some other oil salesman comes along and offers to do as good a lubricating job at a lower price," in which case the brands may be changed and possibly some real changes in lubricating practice effected. One astute superintendent boasts that he plays these salesmen against each other, year by year, feeling that thus he is making the most of the expert lubrication advice obtainable. However, he is probably paying something for this dependence on outside experts and would doubtless find it profitable to make a close study of lubrication on his own account.

An Unusual Case

In one district, the largest operator conducts a general mining supply business in addition to producing ore, Among the supplies, he carries lubricants, acting in respect to these as the local agent for a prominent refiner. The latter's sales engineer has his headquarters at the warehouse. Thus the operator is comfortably on the inside of the lubrication game in this particular region. His rock-drill repair man, moreover, had been trained to act as expert on lubrication, having supervision of all matters pertaining to it underground, particularly as to drills, and acting in an advisory capacity with respect to lubrication of equipment on the surface. This operator, moreover, uses only one make of rock drill, and the drill repairman acts also as service man for the maker in the district. Needless to say, the drills at this particular mine are well lubricated and maintained in good condition.

Reciprocity plays a part at times in the purchase of lubricants. The refinery may be a customer of the mining company. The interlocking of financial interests also may produce similar results.

A.H.H.

This discussion will be continued in a future issue when the prevailing practice regarding sampling and testing, specifications, and related matters will be considered.

Digest of Current Literature

Mine Ventilation. G. E. McElroy and A. S. Richardson. Technical Paper 447, entitled "Experiments on Mine Fan Performance," U. S. Bureau of Mines. The authors present the results of tests on mine-fan performance, carried out in Butte mines in 1926 and 1927. Summarizing, they make the following points:

1. Performance may be regarded as constant for all practical purposes; the designations "blower," "exhauster," and "booster" refer only to the position of the fan with reference to the system it ventilates and not to changes in fan performance. Only one set of characteristic curves is needed, therefore, for any fan to determine its performance at any position in the ventilating system.

2. A fan operates to create an increase in total pressure in the direction of flow; the resistances of the ventilating system cause a decrease in total pressure in the direction of flow. Total pressure is the sum of two mutually convertible components—static pressure and velocity pressure — whose proportions depend only on area of cross-section.

3. Prevailing practice of rating fan performance and ventilating-system resistances on a static-pressure basis causes much confusion in mine-ventilation practice and may easily result in errors of greater or less magnitude, depending on the type and degree of complexity of the ventilation installation. It is recommended that both fan performance and ventilation-system resistances be considered on a total-pressure basis for both simplicity and accuracy.

Mineralogy. Steinmetz. *Zeitschrift für angewandte Chemie,* June 22, pp. 691-2. The science of mineralogy has changed its major emphasis, in the last few decades, from the descriptive and collecting aspects to give greater attention to the differentiation of materials. This involves consideration of the formation of minerals from their magma. The Goldschmidt theory assumes that the formation proceeds according to the specific gravity and volatility of the minerals, forming first the metallic core which contains the iron and platinum metals. This was followed by the separation of sulphidic and siliceous melts as the magma cooled. This theory divides mineral materials into siderophilic, chalkophilic, lithophilic, and aërophilic. The Niggli conception of formation of ores and minerals during cooling of the silicate magma is also discussed.

Auriferous Pyrites. F. W. Freise. *Metall und Erz,* June, second number; pp. 301-6. A study has been made of the losses of precious metal in working up auriferous pyrites. Experimental results are tabulated, and a critical discussion of the data is given. The conclusion is reached that, in the chloride roasting process, it makes no difference whether the salt is added before or after comminuting the ore. The former would give more uniform distribution of the chloride. Adding the salt in solution would give still more uniform distribution, but would complicate the process by the necessity of removing the water. The loss of gold is somewhat decreased if the ore is preheated before adding the salt. On a large scale, however, this adds too much labor expense, unless the roasting can be done in an easily charged rotary furnace. Of all roasting procedures, the best seems to be a slow temperature rise with no sudden changes. Next in preference is to heat quickly to a given temperature stage, hold that temperature constant for a time, then heat quickly to the next stage and so on. The loss is proportionally the same for high or low gold content, so that the gold loss is relatively no worse in unsuitable treatment of a rich ore than of a poor one. A treatment is described which is applicable to some ores and which, from small scale trials, seems suitable for complete recovery of gold from pyrites on a large scale. The ores used in these experiments included iron pyrites with and without arsenic, with high, medium, and low gold content, and an arsenical copper pyrite ore.

Electrical Prospecting. Karl Sundberg and Hans Lundberg. *Bulletin* (May) of the Institution of Mining and Metallurgy. A brief discussion of the theory and general procedure of ore prospecting by Swedish methods is followed by a presentation of results obtained in three areas—Boliden, in Northen Sweden; Questa, in New Mexico; and Buchans, in Newfoundland. In the first instance, the account includes the story, now well known, of how the presence of masked orebodies was indicated by electrical methods and proved by subsequent drilling and development. The survey at Questa showed the possibility of using electromagnetic methods for finding small veins with poor conductivity in country of very rugged topography. Regarding the investigations in the third district, the authors say that the value and usefulness of electrical prospecting have been well proved by the work done there, and that it is extremely doubtful whether the very important orebodies discussed would ever have been found without the methods used.

Poling Copper. P. Siebe. *Metal Industry* (London), July 5, pp. 3-7. A study has been made of the nature of the changes which occur in poling copper. Examination was made of fractures of button samples; of the macro-structure and surface of slabs; of density and gas absorption, and of electrical conductivity. As removal of oxygen by the wood progressed, it was observed that the fracture and structure become finer; then quite coarse if the copper is overpoled; then very fine again. In eutectic copper the set curve shows a depression, which becomes shallower and, in overpoled copper, changes to a convex shape. The surface of eutectic copper is bluish; of tough-pitch copper, reddish, becoming more dull in overpoled copper. Density rises until the oxygen content comes to about 0.25 per cent, and then decreases. The purer the copper, the greater the final drop in density and the greater the gas absorption. Electrical conductivity also rises as oxygen content falls; but in strongly overpoled copper the conductivity decreases again. From the standpoint of mechanical properties, the tough-pitch state is the best. Overpoling is detrimental to these properties, especially to the hot-malleability; button samples crack when hammered or bent. Poor mechanical properties are attributed to gas holes and to the coarse grain which appears in the early stage of overpoling. By close observation of the surface (set, appearance, and ripple behavior), and examination of button samples, the optimum degree of poling can be observed and overpoling can be avoided.

Hydraulic Classification. G. Bozza. *Giornale de Chimica Industriale,* April; pp. 151-54. A critical discussion is given of the Fahrenwald theory of hydraulic classification as applied to ore dressing (U. S. Bureau of Mines Technical Paper No. 403, 1927). It is shown mathematically that the Fahrenwald theory (of separation of ore particles of different densities by settling in a liquid whose density is controlled) is at variance with true theory; it neglects to consider that rate of fall of a particle depends, in addition to other factors, on the ratio of concentration to that of other species of particles, a variable which changes from moment to moment. It is also shown that Fahrenwald's results do not agree with those attained in actual practice, although the principle of the Fahrenwald classifier is sound and the classification which it gives is excellent. Some consideration is also given to the Richards "hindered settling" method, and to Finkey's criticism of it.

Reflex Furnace. Robert Saxon. *Chemical Age,* Metallurgical Section, June 1, p. 43. A reflex furnace, originally designed for smelting metals in the laboratory, has now been improved so that the heat is better utilized and better results are obtained than with the original design. With this small furnace, it is possible to obtain quickly and easily a temperature of 1,250 deg. C. with an ordinary blowpipe, so that laboratory smelting can be effected even with the refractory oxides of several metals. The construction of the furnace is described and illustrated. Baffle plates are used for conservation and more effective directing of the heat energy. The improved furnace has the advantage of being applicable not only to laboratory smelting of the common metals but also to several metals whose oxides are generally considered quite refractory.

Beryllium. A. Stock. *Zeitschrift für angewandte Chemie,* June 1, p. 570. Beryllium metal has been too rare and expensive to have more than a scientific interest until recent years, when scientific research has revealed the possibility of overcoming the difficulties due to high melting point and applying electrolytic reduction methods to beryllium minerals. In Europe the metal is now being produced by Siemens & Halske, by electrolyzing a mixed fluoride of beryllium at over 1,300 deg. C., using a water-cooled iron electrode. In America a mixed chloride of beryllium is electrolyzed at about 700 deg. C. The price of the metal is still high (about $100 per lb. in Europe), but progress is being made in lowering costs. Numerous possible uses exist for the metal, one being as a deoxidizer in making conductivity copper. For this it is better than phosphorus.

NEWS OF THE WEEK

Summary

CHIEF CONSOLIDATED has struck what is believed to be the continuation of the North Lily orebody at the 900 level of its Tintic Bullion mine, Tintic, Utah. Exploration for this body has been in progress more than a year. Page 189.

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Underground work has been resumed at the Kicking Horse group of Base Metals Mines, near Field, B. C., with completion of the tramway to carry rock to the dumping ground. Page 188.

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Inspiration Copper plans $650,000 improvements on its leaching plant at Miami, Ariz. The entire flow sheet will be changed to accord with better metallurgical practice. Page 186.

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Mason Valley Mines has sold all its properties at Thompson, Nev., to the Empire Iron & Metal Company. Latter's plans are indefinite. A merger with Nevada-Douglas Consolidated is rumored. Page 187.

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Mohawk has started preliminary work at its Michigan mine, in Ontonagon County, Mich. Exploratory mining will start soon. Property has been idle nine years. Page 186.

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American Smelting & Refining has purchased outright the Estelle silver-lead property, Inyo County, Calif., and has leased the neighboring Cerro Gordo property, through which the former will be worked. Page 187.

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Teck-Hughes will soon increase capacity of its mill, in the Kirkland Lake district of northern Ontario, if mining developments continue favorable. Page 190.

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The new Hope mill, Aspen, Colo., burned to the ground on July 21, two hours after operations had been started. Damage, estimated at $100,000, is not covered by insurance. Page 189.

International Nickel Smelter, Copper Cliff, Ont.

International-Mond Nickel Merger Results in Prosperity for Both

By A. D. Loney
Special Correspondent

THE merger of Mond Nickel with International Nickel of Canada, the two chief nickel-producing companies of the world, has now been in effect for more than six months. Results have shown the ridiculous aspects of some of the alarmist reports that accompanied first news of the merger, to the effect that Mond operations would be curtailed and many employees forced out of work.

Operations at Coniston, where the Mond smelter is located, have been speeded up, and at the present time an entirely new sintering plant is being built, which it is expected will substantially increase production capacity of the smelter. Changes have also been made in smelter practice looking to increased efficiency, and the offices have been renovated, every move indicative of plans for continued permanency of operations at this point.

At the Mond mines, employment has been increased. At the Levack mine, where a new hoist is being installed, the shaft deepened, and new deep levels are being opened up, an additional force of 150 men has been taken on. Several new houses have been built for the company to accommodate the additions to the permanent staff which will be brought about by the enlarged operations. At the Garson mine, also a former Mond operation, production continues to be maintained at capacity.

A notable feature of the outcome of the amalgamation has been the manner in which Mond executives as well as old Mond employees have been absorbed by the new organization. Oliver Hall, formerly managing director of Canadian operations of Mond, is now general superintendent of the mining division of International Nickel. W. A. Macdonell, formerly business manager of Mond, is now manager of the Coniston works. F. J. Eager, formerly superintendent of Levack mine, has been promoted to be assistant superintendent at Frood, and Lester Sharpe and W. J. Mumford, also old Mond men, are superintendents of the Levack and Garson mines, respectively.

The extensive advertising and permanency which the nickel operations enjoy are drawing men from all over northern Ontario to work in the Sudbury district. International Nickel is selecting its staff of superintendents, captains, and shift bosses at the Frood from the ranks of experienced and capable miners. Operations, even apart from the Frood, are indisputably the largest single mining activities in Canada at the present time, as indicated by the fact that the Creighton mine, hoisting an average of 6,000 tons of ore daily, is as large a producer as the famous Hollinger, when in the heydey of the latter's prosperity. It is notable also that Ralph Parker, formerly assistant mine superintendent at McIntyre-Porcupine, a neighbor of Hollinger, is now superintendent of the Creighton operation.

Mohawk Starts Work Preparatory to Reopening Its Michigan Property

MOHAWK has started preliminary work at its Michigan mine, in Ontonagon County, preparatory to the reopening of that property. The mine has been idle since October, 1920. The equipment at "E" shaft on the Butler lode is intact, and pumping will be started as soon as the machinery is overhauled.

Adequate exploration of the Butler lode is planned. This lode has shown good ore in the past. Other near-by lodes will also be investigated. The technical staff of Mohawk has long been confident of the value of such work. Sufficient mineral ground is held by Mohawk for large production if developments are favorable.

When closed, Michigan was producing from "E" shaft, which was sunk to a depth of only 879 ft. From this shaft numerous openings were made to test the Ogima and Evergreen lodes as probable auxiliary producing contributors. Production from the Butler lode was largely curtailed by lack of sufficient openings on the vein itself.

Mohawk's engineers recommend that "E" shaft be sunk about 1,200 ft. more, and that at 2,000 ft. exploration be made of the Butler lode by long drifts, east and west, along the vein with an occasional crosscut at right angles to intersect the hanging wall. Should developments on the Butler lode at this depth fail of expectations, opportunity would be offered to drive an exploratory crosscut into both the foot wall and hanging wall, at a depth where there would be fewer lode disturbances. The formation would thus be tested with a greater degree of assurance than could be done in upper levels. Should the Butler lode at depth show mineralization in sufficient quantity to warrant mining, the management would be in position to start drifting in the upper levels immediately, thus providing for steadily increasing production without further loss of time required by sinking.

The Michigan is the second idle property in the Michigan copper district to reopen since the improvement in the metal market, Seneca being the first. With the exception of the Carp Lake prospect, it will be the only Ontonagon County property in operation. Development of cheap power, however, should assure more activity in that region.

Michigan property, Ontonagon County, which Mohawk is reopening. "E" shaft is at the right.

Inspiration Plans $650,000 Changes in Leaching Plant

INSPIRATION Consolidated has nearly completed plans for important improvements to its leaching plant at Miami, Ariz. It has been found that percolation in the leaching tanks is much improved if the slime is removed from the crushed ore before the ore is placed in the tanks. At present this is done by passing the crushed ore through Dorr classifiers. The coarse product from the classifiers is sent to the leaching tanks and the fine material to the concentrator and treated by flotation to recover its sulphide copper. The slime, after flotation treatment, is stored in a pond of the tailings dump and will be treated for its oxide copper as soon as an addition can be made to the leaching plant. This addition will consist of a washing plant in which the ore will be separated into sand and slime by classification and a settling tank system in which the copper will be dissolved from the slime. The new equipment will cost about $650,000. A detailed announcement is expected soon.

Silver Purchase Case Reaches Supreme Court

After two years of litigation in the lower courts, efforts of silver producers to compel purchase of their product by the Treasury of the United States at $1 an ounce have reached the Supreme Court. The American Silver Producers' Association and two Colorado companies—Della S. Consolidated and Spar Consolidated—have petitioned for a review of the decision of the Court of Appeals of the District of Columbia, refusing a writ of mandamus intended to compel the Secretary of the Treasury to purchase 14,589,730 oz. of silver for use in recoinage of dollars melted and sold in accordance with the Pittman Act. The Department of Justice has filed a brief in opposition to the granting of this petition.

C.&H. Holes North Kearsarge Through to Centennial No. 2

CALUMET & Hecla Consolidated, in the Michigan district, has completed holing through from the 43 level drift south from North Kearsarge No. 1 shaft to the bottom of Centennial No. 2. Water from the latter is running through into North Kearsarge and will be handled by pumps in that unit. With the stripping and timbering of the raise and repair work in the shaft, No. 2 will be used to mine the stoping area at depth in the Centennial tract and the ground south of No. 1 North Kearsarge.

At the mill, C. & H. is experimenting with a new steel grinding ball as a substitute for Danish pebbles now used in its Hardinge mills. About 3,000 tons of pebbles are consumed yearly. Substitutes, including cast-iron balls, attempted in the past, have proved unsatisfactory.

Court Rules Idaho Copper Stockholders' Meeting Valid

THE meeting of the stockholders of Idaho Copper, held on June 24, was valid, according to the decision handed down by Judge Dana C. Brinck in the Ada County District Court, on July 24. Legality of the meeting, at which George Graham Rice was ousted from the board of directors, was disputed in a suit brought against Idaho Copper by C. E. Burchfield, of Louisville, Ky., and others. Lack of proper notice to the stockholders was the ground for action, but Judge Brinck ruled in favor of the defendant.

Officials of the company state that settling the suit has cleared the way for development of its properties.

McCracken Mines Optioned to Godbe Brothers

An option and lease on the McCracken mines, 35 miles south of Yucca, Mohave County, Ariz., has been granted to Sam T. Godbe and W. C. Godbe, of Salt Lake City. McCracken was one of the largest silver producers in the Southwest, having shipped nearly $4,000,000 of bullion during the 'seventies and 'eighties.

The new owners have made plans to start development immediately, below the level of the old tunnel, where indications of several radiating veins reported to be rich in silver and lead have been found.

A. S. & R. Acquires California Property

ACQUISITION of the Estelle Mines Corporation property near Keeler, Inyo County, Calif., has been completed by the Western department of American Smelting & Refining, according to A. H. Means, manager. With the Estelle group is acquired a long-term lease on the adjoining Cerro Gordo property, with entry and perpetual easement. The Cerro Gordo has accounted for most of the district's total production of $15,000,000 in silver-lead ores to date.

Estelle ore is handled through Cerro Gordo workings and hauled over the Cerro Gordo cable tramway to the railroad loading station at Keeler, 8 miles distant. Production of the Estelle has been averaging 200 tons monthly of a good grade of silver-lead ore. Thomas L. Chapman will be in charge of operations, which are being centered on favorable ore showings on the 900 level.

The ore occurs in sedimentaries of lower Paleozoic age in the form of pipes at fissure intersections. The largest orebody discovered in the district was the Jefferson stope of the Cerro Gordo, 900 ft. high and 40x80 ft. in cross-section.

Completion of this transaction gives A. S. & R. new holdings in five Western camps, four in Utah and one in California. At Silver Reef, Utah, the company is working at depth to prove a continuation of the ores productive near the surface in the early days; at Park City, Lake Side, and Ophir the company is conducting development work and geologic examinations of groups under option.

Three Montana Parties Make Geological Surveys

THREE field parties of the Montana Bureau of Mines and Geology are actively at work in the state this summer, according to an announcement from the office of Dr. Francis A. Thomson, president of the Montana School of Mines, who is also director of the State Bureau. Only $5,000 was appropriated by the legislature for this year. One party is in charge of Dr. Philip J. Shenon, assistant professor of geology at the School of Mines, who with Theodore Rodlin, an advanced geology student, is completing a geologic study of the Bannack and Argenta fields in Beaverhead County. Dr. Shenon has done much work in this area, where his father was one of the pioneer miners. The other parties, which are investigating non-mining geological problems, are headed by Dr. Charles H. Clapp, president of Montana State University, and Dr. Eugene S. Perry, head of the Department of Geology at the School of Mines.

Dr. Thomson, following a trip to Washington to confer with the office of the U. S. Geological Survey in regard to the completion of the U. S. Geological map of the entire State of Montana, expects to visit the different field parties to familiarize himself with their work and also to make a study of some of the outlying mining districts in various parts of the state and to look into the mineral possibilities of part of the land grant belonging to the School of Mines.

Archaeologists to Study Isle Royale Pits

AN INVESTIGATION of ancient copper mine workings is part of a survey of Isle Royale, in Lake Superior, to be made this summer and next by a staff of geologists and archæologists selected by the University of Michigan. The work is being financed by the State of Michigan with the view of offering the island to the government as a national park. It is known that the island was the scene of mining operations by a prehistoric race, but who the miners were and whence they came is shrouded in mystery. Some authorities believe they were members of a race who preceded even the mound-builders as indigenous inhabitants of this country, though others think that they migrated from South America to obtain copper. A systematic study of the old mine pits will be made in the hope that some clew to the identity of these first miners can be discovered.

Chamber of Commerce Favors More Money for Mine Studies

IN SUPPORT of further appropriations for geological and mining research studies, the U. S. Chamber of Commerce has written the government Bureau of the Budget, as authorized by referenda votes throughout the Chamber membership. The statement reads, "Western organizations in our membership have been especially interested in the opportunities for the Geological Survey and the Bureau of Mines to prepare the way for the development of mineral industries, and our organization members in other parts of the country have been sympathetic, as was indicated by the declaration made by our last annual meeting." It has been the policy of the Chamber to work directly with the Bureau of the Budget, of which it was one of the first sponsors, rather than to refer appropriation matters through Congress.

Michigan Smelts Seneca Ore

The Michigan smelter at Houghton, Mich., is again smelting Seneca's output as well as the product of the Champion, Mohawk, and Isle Royale mills. The plant has undergone many improvements, including the reconstruction of No. 3 melting furnace and the rebuilding of the entire bottom of No. 2 casting furnace.

Mason Valley Properties Sold to Utah Holding Group

MASON VALLEY Mines has sold its properties at Thompson, Nev., to the Eastern Iron & Metal Company, of Salt Lake City, a holding company. The sale includes the Mason Valley and Bluestone mines, mill, smelter, and real estate including cottages and other buildings at Thompson. The consideration was not reported. Mason Valley stopped production on June 23.

Eastern Iron & Metal announces that so far no disposition has been made of the property. According to Joseph Rosenblatt, an official of the company, no effort at present will be made to dismantle the mill, smelter, or other machinery of Mason Valley, as he hopes to dispose of the property as a whole.

It is rumored that negotiations are pending for the merger of Mason Valley with Nevada-Douglas Consolidated, which includes the Ludwig, Casting Copper, and Western Nevada mines. The new combination would put the smelter in operation. Nevada-Douglas and Western Nevada mines are reported to be capable of producing 250 tons daily of sulphide ore of sufficiently high grade to make it profitable to smelt with them the low-grade ores of the Bluestone and Mason Valley mines.

Noranda Acquires Control of Rhyolite Rouyn Mines

NORANDA, operating in the Rouyn area of Quebec, has secured a substantial interest in Rhyolite Rouyn Mines, Ltd., with an option on sufficient additional stock to insure control. A total of $591,500 is involved. This includes a straight purchase of 175,000 shares of Rhyolite at $26,500, and an option on a further 1,575,000 treasury shares at $295,000 plus an option on 1,500,000 vendor shares at $270,000.

Rhyolite Rouyn embraces a large acreage lying adjacent to Waite-Ackerman-Montgomery on the west. The strike of the diabase dike with which the ore on the Waite-Ackerman-Montgomery appears to be related is toward the Rhyolite Rouyn. Noranda will undertake immediate exploration of the new property.

Nevada Geological Surveys Being Made This Summer

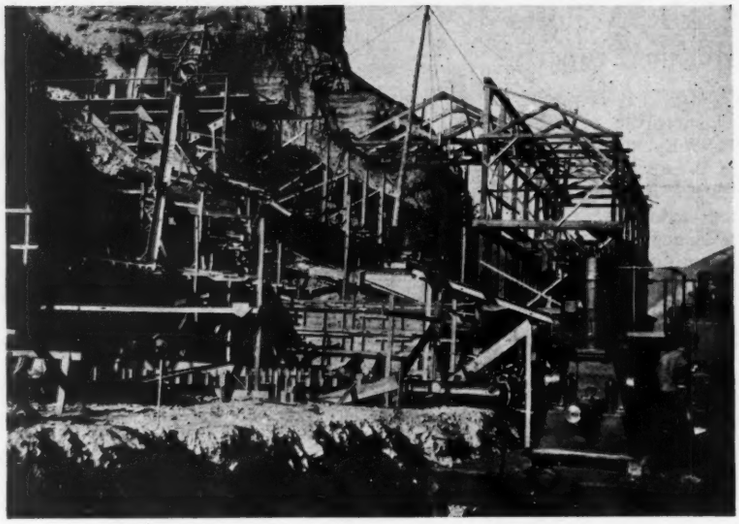
The State of Nevada is carrying out a program of geological research, in co-operation with the U. S. Geological Survey. The state has appropriated $5,000 a year for two years, the federal government contributing a like sum. Field work is being carried on by H. G. Ferguson. Topographic work also is being undertaken under this appropriation. The principal co-operative work now being done in Nevada is a study of the Tonopah region, which is being made by T. B. Nolan.

Underground Work Resumed at Base Metals Mines

UNDERGROUND work was resumed on July 23 in the Kicking Horse group of Base Metals Mines, at Field, B. C. Operation had been suspended for want of dumping ground, as the drifts and other workings were filled with ore. On completion of the ore bins and the tramway thereto, enough of the stored ore was removed to make passage for new ore as broken.

The engineer's report at time of taking over the property and incorporation of the Base Metals Mines, Inc., stated that there was at that time about 300,000 tons of ore exposed or broken in the property and that every face was in ore. Dumping ground was lacking because the mine is located high up on a sheer cliff at the base of which runs the Canadian Pacific Railroad. No removal of ore could be accomplished until a tramway had been completed to carry the ore to the ore bins, which are some distance beyond the railroad tracks.

Construction of the mill and power plant is now almost complete. Power for operations is provided by two 420-hp. Type Y Fairbanks-Morse Diesel engines, direct-connected with a.-c. generators and exciters, and one 180-hp. Diesel of similar type, direct-connected with a Sullivan angle compressor, to supply air to the mine. Provision is made for installation of another 420-hp. unit in case mill capacity is increased.



Site of Base Metals mill and power plant, Field, B. C., showing progress of construction up to July 12

More Students Enter Missouri School of Mines

ACCORDING to a check made in the registrar's office on July 1, there were 38 per cent more applicants for admission to the freshman class of the Missouri School of Mines and Metallurgy this year than at the corresponding date last year. This follows after several years of decreasing entrances.

The School of Mines placed all its graduating class without difficulty, and reports that it would have been easy to find positions for several times the number graduating. Of the 63 graduates, seven entered foreign service, nineteen remained in Missouri, and the others are placed in seventeen different states. Of those going out of the country, six are in South America and one is Mexico.

International Nickel Smelter Chimney Rises

RISING perpendicularly toward its objective of 510 ft., the top of the new smelter chimney of International Nickel of Canada, at Copper Cliff, Ont., was pushed above the western skyline, looking from Sudbury, more than 4 miles away, this week. The chimney has now reached a height of more than 300 ft., and it is expected that another month will see its completion, with the exception of the lining. When completed, the chimney will be the tallest in the British Empire and one of the three tallest in the world.

Manager Recommends Depth Development at Abana

HARRISON E. CLEMENT, general manager of Abana Mines, Ltd., in the Rouyn area of Quebec, in a report to the directors of the company states that reserves comprise 155,000 tons of ore developed or partly developed, and indicated possible ore of 223,000 tons, a total of 378,000 tons. Of this, 208,000 tons lies west and 170,000 tons east of the diabase dike. Below this estimated ore is the No. 1 and No. 2 block. The orebody as indicated by the drill holes appears to be going down with greater width and length. Mr. Clement believes that sufficient evidence is at hand to warrant the statement that the large possibilities of the mine in this section lie below the present development. He recommends the sinking of No. 2 shaft to a depth of 575 ft., with lateral work at the 425 and 550 levels.

Alaska Juneau Buys New Land

Alaska Juneau Gold has acquired a controlling interest in the Manville-Goldstein group of claims, at the Taku River, Alaska. The consideration paid has not been divulged, but Alaska Juneau is reported to have undertaken to spend $200,000 on the development and equipment of the property.

Kootenay-Florence Hits Ore

Ore has been struck in the south fissure at Kootenay-Florence mine, Kootenay Lake, B. C. The south fissure lies 680 ft. south of the main fissure, and has recently been intersected by a crosscut which was started at approximately 4,000 ft. from the portal. It is understood that the 150-ton milling plant will be reconditioned soon.

Nevada Quicksilver Buys Montgomery Group

Nevada Quicksilver, operating in Pershing County, Nev., has purchased the Montgomery group of cinnabar claims, and has installed air drills and a compressor. The claims are thought to contain extensions of the rich Pershing vein system, which they adjoin. Production of Nevada Quicksilver has been increased to 75 flasks weekly. A cross-fissure containing ore of good grade has been opened on the 150 and 200 levels. Sinking the shaft has been resumed with 500 ft. the present objective.

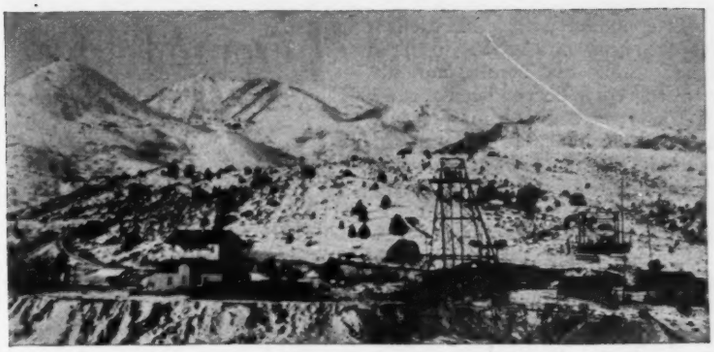
Walker Mining Is Ready to Install New Equipment

Foundations for the new mill additions to the property of Walker Mining, operating in Plumas County, Calif., have been completed. By Aug. 1, the equipment should be installed and the mill ready to treat 1,600 tons or more daily, compared with 1,200 tons at present.

Net earnings of the company, are averaging $90,000 monthly. Indebtedness to International Smelting has been reduced to approximately $320,000.

Western Merger Sinks Shaft

Western Merger Mines, operating the Jackson lode near Nevada City, Nevada County, Calif., is sinking a new shaft 600 ft. south of the original working. Only junore was exposed in the old one.



North Lily shaft, in the Tintic district of Utah, near which Chief Consolidated has struck ore

Chief Con. Strikes Extension of North Lily Orebody

ORE has been struck on the 900 level of Chief Consolidated's Tintic Bullion holdings, in the Tintic district of Utah, about 500 ft. southwest of the main North Lily orebody. Three carloads have been shipped. A stope 18x18x15 ft. has proved that the ore penetrates into virgin ground at the top, bottom, and sides.

This strike follows as a result of nearly a year's exploration to find the continuation of the North Lily orebody in the down-faulted Ophir sedimentaries to the southwest. A winze was sunk from an extension of the 900 North Lily level to the 1,200 level. Work in the quartzite on the 1,200 opened up a small quantity of ore. Development was then started on the 900. After cutting porphyry, the ore was struck in what it is believed will be proved to be Ophir formation, when sufficient development work has been done.

Development of the Eureka Bullion showing on the 1,200 has been stopped temporarily by flooding of the workings with water from the North Lily. As soon as pumping is started, this activity will be resumed.

At the North Lily, two pump units capable of handling 1,000 gal. per minute each are being installed. Water has been struck in a north heading on the 700 level. Flow is estimated to total about 700 gal. per minute. Striking of water had only a temporarily effect on operations.

Development in North Lily's new holdings acquired from the Knight interests, including Twentieth Century, Big Hill, Empire Mines, Eureka Consolidated, Dragon Con., Swansea, Tintic Drain Tunnel, Tintic Central, and other properties, is to be started as soon as titles are perfected.

Amity Copper & Gold Extends Operations

FAVORABLE reports of conditions at the 600 level of Amity Copper & Gold Mines, in the Boston Creek section of the Kirkland Lake district of northern Ontario, have resulted in the directors deciding to sink the shaft to the 1,000 level. Sufficient ore has been opened up to date to provide a supply for a 50-ton plant for at least eighteen months, but it is considered advisable to defer erection of the concentrator until one or two additional levels have been opened up.

Present undertakings include the installation of an electric hoist capable of operating to a depth of at least 2,500 ft. In following the quartz vein back to the granite at the 600 level, a 2-ft. vein containing gold, copper, and silver was encountered.

French Hill Starts Washing

The French Hill hydraulic mine on Trinity River, Del Norte County, Calif., has almost completed its 5-mile ditch and expects to begin washing operations this month.

Utah Copper Will Make Improvements for Bingham

Utah Copper has agreed to build a road and a 200-ton ore bin for Bingham Metals, at Bingham, Utah, in addition to paying a cash consideration for certain surface rights. The last-named company will also have its buildings moved to the collar of the shaft, and will benefit from cheaper transportation rights for moving ore.

Bingham Metals, according to W. H. Mitchell, president, has $17,000 in the treasury. The company plans to sink its shaft 100 ft. vertically from the 900 level. Ore is being mined from a 6-ft. vein on the 900 level.

Utah Companies Install New Large Equipment

One of the largest gallows frames erected by a Utah mine is being made for Eureka Standard by the Provo Foundry & Machinery Company. The frame is 85 ft. high.

At Tintic Standard, an Ingersoll-Rand compressor is being installed, with a capacity of 2,750 cu.ft. of free air per minute.

Consolidated Coppermines Drains Alpha Shaft

WATER in the Alpha shaft, one of Consolidated Coppermines' two main five-compartment shafts, in the Ely district of Nevada, has been reduced 50 ft. below the 1,300 level. Incrusted ore, of the highest grade yet found in the shaft, was revealed by the draining operation.

As a result of improvements effected in the last six months, Consolidated was recently enabled to reduce its working force by 200 men, at the same time increasing output. Production is now at the rate of 2,000,000 lb. per month, and the management expects a further sharp increase by Sept. 1. Total for the year is expected to exceed 30,000,000 lb.

Consolidated's output now comes entirely from its own shafts, as operating difficulties encountered by Nevada Consolidated forced suspension of work at the Ora claim in the Liberty pit. Resumption of work on this claim would further increase Consolidated's production.

Many Geological Expeditions Seek Minerals in U. S. S. R.

HUNDREDS of geologists, comprising 72 different expeditions, have been sent out this summer by the Soviet government to search for and map the mineral resources of the vast Union of Soviet Socialist Republics. Parties are working in many widely scattered parts of the country.

Of the geologists, 30 expeditions are seeking gold, and three, platinum, in the Ural Mountains, central Siberia, and the Far Eastern Republic. Into Karelina, in central Russia; the Caucasus; the Urals; the trans-Baikal region; Russian Turkestan; and the Ferghana Mountains, near Afghanistan, have gone 29 parties, with their objects asbestos, mica, porcelain clays, graphite, sulphur, and gems. Salt and phosphate minerals draw ten expeditions to the Akmolinsk and Irtysh districts of Siberia and to the shores of the Sea of Azov.

Fire Destroys Hope Mill Two Hours After Opening

FIRE completely destroyed the new mill and practically all of the surface property of Hope Mining, at Aspen, in the Leadville district of Colorado. The new mill had not been in operation more than two hours, on July 21, when the fire, thought to be caused by defective wiring, put a complete end to work of the company. Loss, estimated at $100,000, was not covered by insurance. Rebuilding the plant is unlikely at present.

Mexico City Letter

By W. L. Vail
Special Correspondent

Provisions of Proposed New Labor Law Burdensome to Employers

Mexico City, July 28, 1929.—The proposed labor law is now attracting much interest. Congress was called in extra session on July 25 to take action on a law recommended by President Portes Gil. The prevailing opinion is that it will be passed without important amendment. According to those representing large investments of capital, the general tendency of the law will be to increase the burden on the employer, thus slowing up new enterprises. According to the provisions of the law the employer will be made liable for damages in favor of workmen to the full value of any property he may hold; whereas the workman is granted privileges and his liability is limited. Another disagreeable feature of the new law to the capitalist is that the organization of laborers' unions is obligatory; and in many instances the work of organization will devolve upon the management itself. It is estimated that under the law in its present form cost of production for the average mining company will increase 14 per cent, owing to the provision of additional holidays, a 5 per cent insurance tax, and other extra burdens.

According to wireless advices received in this city from Santa Rosalia, 3,100 men walked out of the mines and smelter of the Boleo company's mines near Santa Rosalia, Lower California, on July 25. There had been a demand for the dismissal of a French superintendent who was objectionable to a number of the leaders of the workmen, which was complied with. No further demands are thus far known to have been made. Some two months ago the company ordered a perpendicular raise of 90c. per day for common miners, and it is not thought that the question of wages entered into the present situation. The trouble is set down, by government authorities here, as the result of the machinations of foreign agitators who have been spreading propaganda in various camps on the west coast for months. The steamer "Korrign III," property of the Boleo company, is under steam at the wharf waiting for orders from the federal government to transport troops to the scene of trouble, should the situation get out of hand of the local authorities. The camp has been working peacefully and steadily for some time, turning out an average of 23,750 tons of copper ore monthly.

A number of new mining denouncements are reported from the head mining office in the city of Oaxaca. One of the most important is an old antimony property, Los Tecelotes, in the municipality of San Juan Mixtepec, District of Tlaxiaco. The Realidad, an old working in the Ejutla district, has recently been denounced by George S. Clark, of Oaxaca, and the Royal Crown has also been recently redenounced by Claude B. Finney, also of Oaxaca City. Work has been practically suspended at the Majestic mines, in the Teoloapam district, until after the rainy season. The new highway to Tehauntepec has been completed to Toloapam and was formally taken over last week by the government. Considerable new road work that will facilitate mining development is under way in various parts of the state.

Plans for the erection of a flotation plant at the cost of about $70,000 are reported by Noria de Los Angeles Mining, district of Pinos, State of Zacatecas. Engineers report a large quantity of low-grade ores on the dumps which can be economically worked under modern conditions. General conditions for operation in the Pinos district are good.

New Orebody Developed at Tonopah Extension

A NEW orebody has been opened up on the 1,880 level of Tonopah Extension, in the Tonopah district of Nevada. The ledge, more than 20 ft. wide, lies to the west of the main producing area. Ore is of good mill grade, increasing in richness near the hanging wall.

As a result of this discovery, it is expected that East Butte Copper will resume work in its Tonopah Western group, which adjoins the Extension area. The 1,200-ft. Tonopah Western shaft is no longer flooded, making development much more practicable than it has been.

Total silver production from mills of the Tonopah district in June was 174,000 oz., valued at $116,900. This is the highest yield since last February, but earnings were not so great as they have been, because of the lower price of the metal. Bradshaw, Inc., reported earnings of $30,000, and led the district.

RHODESIAN DRILLING RESULTS

Roan Antelope Mines reports that drill hole No. 36 has cut ore at a depth of 1,845 ft. This hole shows 13.3 ft. of ore, true width, of an average copper content of 3.46 per cent. Grade of ore was precisely the same as cut in hole No. 19, which showed 9.5 ft. of ore at 667 ft. depth, and which No. 36 offsets on the dip. The depth, the greatest yet reached at Roan Antelope, was more than had been expected. This confirms what the neighboring holes Nos. 42 and 48 had indicated, that the orebody steepens out with depth, making the large and rich body easily workable.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Teck-Hughes Will Increase Milling Capacity Soon If Developments Continue

Toronto, July 27, 1929—C. L. Dennison, president of Teck-Hughes, in the Kirkland Lake district, states that as soon as the six new levels, between the 19 and 25, have been opened up, and providing developments justify it, milling capacity of the mine will be increased. This is in accord with opinions previously expressed, but is the first official statement on the subject. So far as developments have progressed on these new levels they are fully up to expectations. Mr. Dennison states that the 80-ft. width of ore zone on the 25 level is the widest that has yet been found in the mine; some of the company officials believe that the 25 level will be more important than the 13. Ore is now being developed on three of the new levels—the 20, 21, and 25. It is quite probable that work will have advanced by fall sufficiently to justify the company in starting on a new mill unit, in order that the building may be fairly well completed before the cold weather sets in.

With a production of over $700,000 in June, Lake Shore was the leading gold producer in Canada, and for the first time a Kirkland Lake mine has exceeded the output of the Hollinger mines, of Porcupine. The high output in June is partly the result of a year-end cleanup and partly of an additional tube mill, the installation of which was completed during the month and which brought the tonnage to 1,500 tons a day. Though the full effect of this increase in tonnage will not be felt until July, it is doubtful if figures for that month will equal those for June.

Earnings of the Noranda mine, of Rouyn, are now running at $500,000 a month, or at the rate of $2.65 a share per year before depreciation. Within the next three months it is expected that tonnage will be increased to 1,800 tons a day, as against the present 1,300 tons, and will gradually be stepped up from 1,800 tons to the capacity of the plant, which has yet to be determined. During the coming year earnings will probably be at double the present rate, as the tonnage will be practically doubled and the grade of the ore may be increased as larger amounts are taken from the higher grade "H" orebody. Preparations are now being made underground to take care of the increased tonnage. All orebodies are being intensively developed above the 500 level, and between the 500 and 975 levels work is being largely confined to the development of the "C" and "H" bodies.

MARKET AND FINANCIAL NEWS

London Financial News

By W. A. Doman
Special London Correspondent

London, July 16, 1929.—At the moment, talk in mining circles is confined mainly to the tin position. The projected Tin Producers' Association has taken definite shape, and a first meeting of the committee has been held. Although Sir Edmund Davis presided, delivered a carefully prepared speech, and read out the names of the committee appointed, he is not himself on that body. The position was not altogether clear. About 167 companies and firms were invited to participate and about 300 directors and delegates attended. Who appointed the committee was not stated, and the subsequent discussion by it was private. Now there are 21 members formulating plans for a constitution.

The two parties—for and against stabilization—are still as opposed as ever, and some of the delegates, if they were silent at the meeting, had certainly expressed themselves vigorously outside. Those in favor of stabilization suggest a price of between £220 and £250 per ton, and are of opinion that the interests of the industry would be served thereby. The opposition party brings forward big guns and suggestions. C. V. Stephens, who knows the East as few of the others do, asserts that restriction would ultimately aggravate the position by keeping alive uneconomic properties, in addition to which it is not possible to control tin production because the native element cannot be convinced. And the native element is strong.

In other quarters suggestions are made that the proposal is to keep alive unprofitable Nigerian undertakings; also to enable the hidden stocks of tin to be marketed at a profit. Restriction and a high price would lead to the use of substitutes; on the other hand, it is suggested that with the price at a stable level there would be increased use of the metal. Those who favor combination and restriction point to what has been done in copper and lead; the opponents argue that copper and lead now stand at a lower level than before. And so the wrangle goes on. Today the price per ton is £214 12s. 6d. for cash and £217 18s. 9d. for three months. To some extent this improvement is attributed to buying from the United States, consumers and dealers there being desirous of satisfying immediate and near future requirements before any sustained rise can take place.

Considerable interest has been taken in developments regarding Bolivian tin, owing to the sale of the Williams Harvey smelter at Liverpool. The owners originally were the National Lead Company, of America, and Simon Patiño, president of Patiño Mines & Enterprises. National Lead has sold its 50 per cent interest, consisting of 36,000 shares, for £18 10s. 0d. per share to Patiño Mines. Simon Patiño has also sold his half interest to the Patiño company, which now owns the smelter in its entirety. Apparently there has been a little trouble owing to what the Bolivian company considers the high charges for smelting the Bolivian ores. It is assumed in some quarters that the control of Bolivian tin is not unfavorable to stabilization.

American Zinc, Lead & Smelting and its subsidiaries report for quarter ended June 30, 1929, profit of $301,456 after charges but before depreciation, depletion, and federal taxes, comparing with $314,908 in the preceding quarter and $229,083 in the corresponding quarter of 1928. Profit for the first half of 1929 totaled $616,364 before depreciation, depletion and federal taxes, against $409,322 in the first six months of the previous year.

Canadian Lead Production Established New Record

Finally revised statistics on the production of lead in Canada in 1928, as reported by the Dominion Bureau of Statistics at Ottawa, show that a new record in quantity was established when the total recovery amounted to 337,946,688 lb., worth $15,553,231, as against 311,423,161 lb., worth $16,477,139, in 1927. Details of production, import and export are given in the following table:

	1927		1928	
	Pounds	Value	Pounds	Value
Production, by Provinces:				
Quebec	6,496,577	$341,461	6,218,336	$284,520
Ontario	7,990,709	528,729	6,814,757	402,289
British Columbia	292,770,544	15,388,020	317,722,146	14,537,377
Yukon	4,165,331	218,929	7,191,449	329,045
Total	311,423,161	$16,477,139	337,946,688	$15,553,231
Imports:				
Old and scrap, pig and block	405,127	$33,165	531,404	$31,141
Bars and sheets	112,039	8,906	161,970	10,742
Litharge	3,015,000	245,630	3,977,300	279,136
Acetate and nitrate of lead	337,044	28,218	261,768	21,382
Other manufactures	.....	344,053	.....	342,349
Pipe lead	109,296	8,456	184,754	13,648
Shots and bullets	14,129	1,514	11,158	1,408
Tea lead	59,808	5,936	34,650	3,022
Lead pigments:				
Dry white lead	338,399	24,879	289,001	21,761
White lead, ground in oil	360,301	28,252	492,497	39,211
Dry red lead and orange mineral	1,844,288	125,358	1,469,943	100,733
Total	.....	$854,367	.....	$864,533
Exports:				
Lead contained in ore	13,032,600	$844,637	14,962,900	$893,709
Big lead	239,409,100	11,981,388	255,421,700	10,172,075
Total	252,441,700	$12,826,025	270,384,600	$11,065,784

Bwana M'Kubwa Reports Loss of £23,687 for Year

Bwana M'Kubwa Copper Mining Company, Ltd., reports loss from operations in year ended March 31 of £23,687, against loss of £169,784 for the previous year. Shares of Rhodesian Selection Trust, which were acquired for the purpose of participation in the prospecting venture of that company, were realized upon with a resulting surplus of £107,128. After deducting the £23,687 loss for the year, net surplus of £83,441 remained. This, together with £206,017 transferred from premium on shares account, was sufficient to write off debit balance of £289,458 brought forward from March 31, 1928.

Sales of copper increased to £423,567, from £189,843 for the preceding year. Ore reserves at the N'Kana Mine on June 1 totaled 35,000,000 tons, averaging 4.2 per cent copper. Of this, 31,000,000 tons is sulphide ore and 4,000,000 tons mixed oxide and sulphide ore.

Eagle-Picher Lead Company reports for six months ended June 30, 1929, net profit of $994,993 after depreciation, depletion, and federal taxes. For six months ended June 30, 1928, profit after depreciation and depletion, but before taxes, was $426,135. The company's bank loans were reduced to $100,000 at June 30, 1929, from $2,950,000 on June 30, 1928.

Magma Copper Company, operating in Arizona, produced 9,892,826 lb. of refined copper during the three-months period ended June 30, 1929. Cost of production, after deducting gold and silver credits, was 9.58c. per pound. Net earnings, before paying federal taxes, were $813,737.

Butte & Superior Shows Gain for Quarter

THE Butte & Superior Mining Company reports for the quarter ended June 30 a profit of $40,554 after expenses, depreciation, and taxes, but before depletion, equivalent to 14c. a share earned on 290,197 shares of stock. This compares with a loss of $15,623 in the preceding quarter and a profit of $21,826, or 7c. a share, in the June quarter of 1928. Profit for the first six months of 1929 totaled $24,931 before depletion, equivalent to 8c. a share, against $61,719, or 21c. a share, in the first half of the previous year.

In the second quarter of 1929 the company produced 58,808 tons of zinc ore averaging 13.78 per cent zinc and 6.43 oz. of silver a ton, compared with 61,922 tons in first quarter averaging 12.81 per cent zinc and 6.46 oz. of silver. The company also mined 1,716 tons of copper ore averaging 3.34 per cent copper and 5.17 oz. of silver a ton in second quarter. In first quarter no copper ore was produced. The average price obtained for zinc in the second quarter was 6.65c. a pound against 6.40c. in preceding three months; for silver 54.13c. an ounce, compared with 56.52c. in the first quarter. The average price obtained by the company for copper was 18.07c. a pound.

Canadian Cobalt Output Increased in 1928

Canada's cobalt production in 1928 amounted to 956,590 lb., valued at $1,672,320, against 880,590 lb., valued at $1,764,534, in 1927, according to a bulletin giving finally revised data issued by the Dominion Bureau of Statistics at Ottawa. Production included the cobalt content of the various cobalt products sold by the Deloro Smelting & Refining Company, Ltd., which treats most of the silver-cobalt ores of Ontario, and the cobalt content of ores and residues exported for treatment in foreign smelters. The value reported is the net amount received by the shippers, and decreased slightly last year, despite the increased production. In addition to the exports from Ontario a small shipment of ore containing gold, arsenic, and cobalt was made in 1928 from British Columbia to Australia.

Canada produces about one-half of the world's supply of cobalt; the remainder is produced by the Union Minière du Haut-Katanga, in the Belgian Congo, where cobalt occurs in association with copper.

SOUTH AFRICAN MICA PRODUCTION during the first quarter of 1929 amounted to 837,532 tons, slightly more than double the output of the corresponding quarter of 1928. The production in Southern Rhodesia amounted to 79,893 lb. in the first quarter of 1929, and there was no production in Northern Rhodesia. Though exports are still very small, interest in mica has been growing. Efforts are now being made to put scrap mica into salable condition.

Northern Rhodesian mica is all ruby muscovite. Production has been inconsequential and intermittent to date, but with the present development in the Kafue fields there is a possibility of a fairly large future production from this province.

Is the Country Using Less Lead?

FIGURES recently compiled by the American Bureau of Metal Statistics show a decline in domestic lead shipments for the third successive month. Whether or not this is seasonal cannot be exactly determined, as comparable statistics were not issued a year ago, but it evidently is not confined to any one group of consumers as the following tabulation shows:

Domestic Lead Shipments, in Tons

Class of Consumer	June	Average Jan.-June
Cable	15,496	16,896
Batteries	5,140	6,950
Tin foil	2,543	2,508
Sundries	2,051	3,062
Ammunition	1,437	2,871
Jobbers	454	698
Brass-making	239	278
Unclassified	30,355	30,784

The highest shipments in the last year were recorded in March, 1929, when 72,774 tons was shipped. In April the tonnage was 67,164; in May, 61,933; and in June, 57,715.

Increased Output in 1928 of Secondary Metals

THE value of the more important non-ferrous metals recovered from secondary sources in 1928 is reported to the U. S. Bureau of Mines as $277,623,500, which is $21,271,500 more than in 1927. This increase in total value is to be credited mainly to larger recoveries of copper, brass, lead, and nickel, and to the higher average price of copper in 1928. There were large gains in the quantity of secondary copper, lead, and nickel in 1928, and small increases in the quantity of secondary zinc and aluminum, and small decreases in the quantity of tin and antimony.

Secondary Metals Recovered in the United States, 1927-28

	1927 (Short tons)	1928 (Short tons)
Copper, including that in alloys other than brass	290,000	325,000
Brass scrap remelted	286,000	302,000
Lead as metal	119,000	138,000
Lead in alloys	157,000	170,600
Zinc as metal	64,800	70,700
Zinc in alloys other than brass	12,400	12,500
Tin as metal	8,800	8,200
Tin in alloys and chemical compounds	28,100	27,600
Antimony as metal	1,700	745
Antimony in alloys	10,700	11,155
Aluminum as metal	23,000	24,500
Aluminum in alloys	23,200	23,300
Nickel as metal	480	635
Nickel in alloys and salts	2,900	3,865

Indian Government Sells Silver on Larger Scale

THE Indian government has been able to export appreciable quantities of fine silver this year resulting from establishment of an electrolytic silver refinery in Bombay, the U. S. Department of Commerce learns from a leading Calcutta daily. Actual silver exports on government account during March came to 1,948,535 oz., valued at 2,838,000 rupees, and during April to 5,317,239 oz., valued at 7,719,000 rupees. These sales of silver were made by the government in pursuance of the recommendation of the Hilton Young currency commission that surplus silver should be gradually disposed of and replaced by gold assets.

Installation of the refinery means that the government will have available for sale fair amounts of fine silver month after month and that the policy of spasmodic selling will yield to one or regular sales as and when prices are suitable.

Coniaurum Shareholders Approve Reorganization

Shareholders of Coniaurum Mines, operating in the Porcupine district of northern Ontario, have ratified an agreement to surrender their charter and transfer the assets of the company to a new organization under the same name. The action of the shareholders was unanimous, and the stock represented at the meeting comprised 88 per cent of the whole. Shareholders will receive one new share for each two shares of the old company. The new company is amply financed to enable the workings to be carried to a lower horizon, where there is a promise of high grade ore.

CANADIAN ARSENIC PRODUCTION in 1928 amounted to 5,432,223 lb., worth $193,502, as against 6,227,968 lb., valued at $211,979, in 1927, according to the Dominion Bureau of Statistics. Ontario mines yield the larger part of Canada's arsenic output. Silver-cobalt ores are smelted at Deloro, Ontario, and from these white arsenic and arsenic-bearing speiss residues are obtained. In British Columbia, the ores of the Nickel Plate mine furnish most of the arsenic reported from the province. Exports of arsenic in 1928 were 3,194,999 lb., valued at $122,106, and imports, in the form of compounds and insecticides, had a total value of $19,625. Exports decreased slightly and imports increased slightly from 1927 figures.

BUTTE COPPER & ZINC COMPANY, operating in Montana, reports for six months ended June 30, 1929, net income of $98,103 after expenses and taxes. This compares with $87,176 earned in the first half of 1928, and $40,241 in the similar period in 1927. There was mined in the first six months of 1929, 81,754 tons of ore, comparing with 78,780 tons in first half of 1928.

Rhodesia Minerals Concession Plans Recapitalization

A PLAN for reorganization of Rhodesia Minerals Concession, Ltd., has been submitted to the stockholders for approval. Subject to dissolution of the existing company and formation of a new one, the British South Africa Company will grant to Rhodesia Minerals an extension of prospecting rights on all territories now held, with the exception of three recently ceded to Luiri Gold Areas, until April 30, 1935. Under the new grant a minimum of £12,500 yearly must be spent on exploration. Rhodesian Anglo-American, Ltd., will act as consulting engineers and managers in Rhodesia for the new company.

There will be created 800,000 shares of 5s. par, of which 388,706 shares will be issued. Of these, 134,874 shares will go to the present stockholders, who will receive three shares in the new company for every four now held. British South Africa will buy 89,916 shares for cash; and receive 50,000 shares in return for the grant. Of the remaining shares, 89,916 will be offered for subscription, and 24,000 are given to Loanga Concessions, Ltd., for purchase of lands. Both British South Africa and the new shareholders will be granted options on unissued shares.

No development of discoveries made by Rhodesia Minerals may be dealt with except by formation of another company, in which British South Africa will be entitled to a large interest.

IDAHO MINE PRODUCTION in 1928 amounted to $26,667,706, as compared with $28,104,413 in 1927. A total of 2,054,329 short tons of ores of all kinds was treated by 207 producers, as against 2,018,325 tons by 218 producers the previous year. Production by individual metals was 20,980 oz. of gold, (15,315 oz. in 1927); 8,998,330 oz. of silver, (8,901,409 oz. in 1927); 2,072,165 lb. copper, (2,173,163 lb. in 1927); 290,645,905 lb. lead, (292,038,423 lb. in 1927); and 62,526,648 lb. of zinc, as compared with 53,556,345 lb. in 1927.

AMERICAN METAL COMPANY, LTD., reports for the quarter ended June 30, 1929, net profit of $891,854 after federal taxes, depreciation and reserves, equivalent after allowing for dividend requirements on 7 per cent preferred stock, to 94c. a share earned on 841,478 no-par shares of common stock. This compares with $766,471, or 78c. a share, on 840,996 common shares in the preceding quarter and $640,850, or 85c. a share, on 595,114 shares in the June quarter of 1928.

Tungsten Monopoly Exists in Central China

CENTRAL Chinese tungsten producers are apparently creating a monopolistic situation, according to advices received by the U. S. Department of Commerce. According to Hankow tungsten dealers, there are no tungsten supplies uncontracted for at either Hankow or at Changsha.

On the expiration of its monopoly of the market for central China, the Feng group is reported to have had about 600 tons of tunsten ore on hand in Kiangsi Province. The Laing group, which succeeded to this monopoly at the end of March, has been trying to buy this supply, but its offers have been much below the present market price and the owners have declined to sell. Under its monopoly rights, however, the Laing group has thus far been able to restrain the Feng group from selling the supply to other interests or shipping it out of the province.

In the meantime, production in Kiangsi is reported to have proceeded at the rate of about 200 tons a month, so that approximately 1,000 tons of tungsten ore is now awaiting shipment. The new holders are apparently holding up shipments with the intention of forcing the market price to a higher level.

Imports and Exports of Ores and Metals in June, 1928 and 1929

Compiled from U. S. Department of Commerce Records

In Pounds, Unless Otherwise Stated

Imports

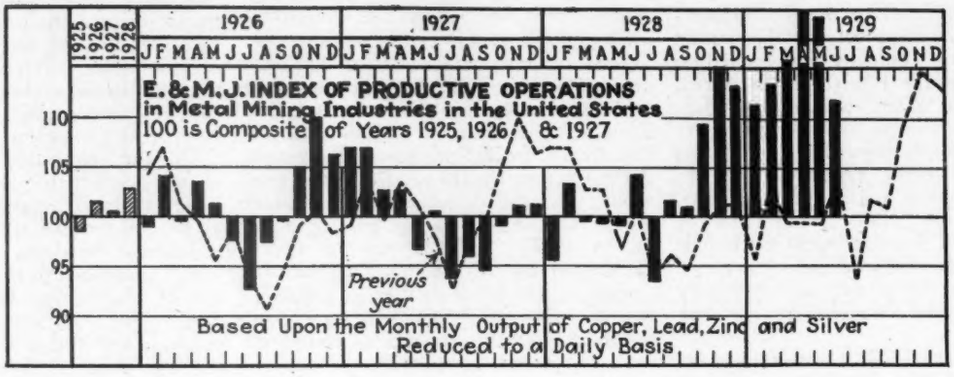
	June 1928	June 1929
Antimony		
Ore { Gross weight	576,186	760,341
Ore { Antimony content	316,524	478,204
Copper		
Ores, copper content	8,851,800	10,733,468
Concentrates, copper content	2,833,830	3,351,524
Regulus, coarse metal, cement copper	331,104	88,123
Imported from:		
Spain	538,241	957,106
Canada	4,126,076	5,624,010
Mexico	3,498,705	3,247,540
Cuba	.....	10,412
Chile	3,643,619	3,944,759
Peru	79,599	108,094
Other countries	130,494	281,194
Unrefined converter copper in pigs, bars and other forms	46,265,609	58,492,547
Refined copper	5,498,542	14,529,846
Old and clippings	859,212	1,306,064
Composition metal	17,713	.....
Brass, old, for remanufacture	1,289,450	1,082,816
Lead		
Ore and matte, lead content	6,705,160	3,127,738
Bullion or base bullion	21,181,020	15,295,988
Pigs and bars, old, and scrap, lead content	1,118,735	400,271
Babbitt, solder, other forms { gross weight	101,184	116,543
Babbitt, solder, other forms { lead content	43,402	46,610
Type metal, antimonial lead { lead content	959,283	137,955
Type metal, antimonial lead { gross weight	1,231,934	167,991
Manganese, tons		
Cuba, manganese content	.....	.....
Other countries, manganese content	12,650	51,290
Pyrites, tons	.....	.....
Tin, ore, tons	5	8
Bars, blocks, pigs	11,312,472	16,016,738
Imported from:		
Netherlands	1,175,925	1,474,735
United Kingdom	1,387,092	2,040,244
British Malaya	7,624,329	11,374,614
Netherland East Indies	.....	224,323
Hongkong	67,219	796,363
Australia	318,080	67,200
Other countries	739,827	39,259
Zinc		
Ore, zinc content { Free	2,850	.....
Ore, zinc content { Dutiable	221,000	165,280
Blocks, pigs and other forms, old	.....	.....

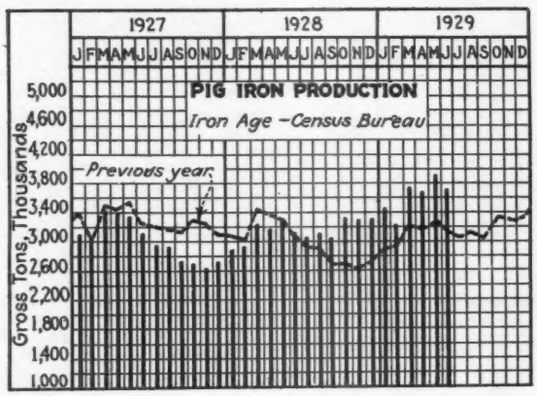
Exports

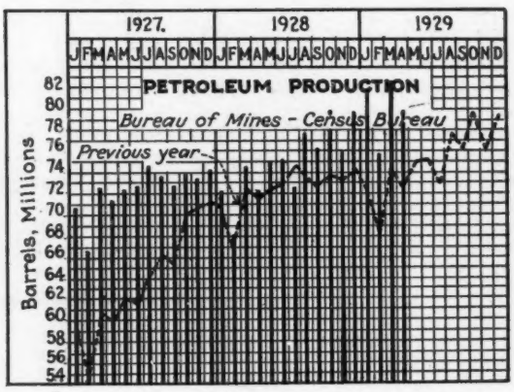
	June 1928	June 1929
Copper		
Ores, composition, concentrates, unrefined	60,026	179,762
Refined copper in ingots and other forms	87,072,752	71,817,042
Exported to:		
Belgium	7,264,123	6,200,456
France	15,896,566	13,646,815
Germany	20,298,790	17,186,471
Italy	8,909,638	5,741,739
Netherlands	6,078,970	3,793,268
Spain	55,847	33,574
Sweden	3,691,279	2,682,594
United Kingdom	13,165,967	15,121,053
Other Europe	774,049	3,479,998
Canada	4,165,625	2,327,019
British India	113,360	.....
China, Hongkong, Kwantung	2,329,600	471,620
Japan	4,163,290	896,192
Other countries	165,648	236,243
Old and scrap	5,071,175	2,399,220
Pipes and tubes	315,321	285,813
Plates and sheets	465,010	360,856
Rods	6,500,941	5,738,451
Insulated copper wire and cable	1,982,889	2,150,901
Lead		
In pigs, bars and other forms	.....	.....
From foreign ore	13,051,738	5,977,758
From domestic ore	3,524,168	3,144,509
Exported to:		
France	392,148	191,457
Germany	4,627,132	280,156
Netherlands	504,111	280,073
Sweden	1,008,257	851,534
United Kingdom	5,489,510	4,375,951
Other Europe	728,269	168,011
Brazil	224,005	224,103
Other South America	13,887	135,692
China, Hongkong, Kwantung	114,205	.....
Japan	3,427,579	2,521,129
Other countries	46,803	94,161
Other lead manufactures	872,255	1,246,840
Zinc		
Ores and concentrates, tons	.....	54
Dross	536,984	411,927
Cast in slabs, blocks and pigs	3,418,615	1,477,111
Exported to:		
Belgium	56,046	404,071
France	727,991	336,075
Germany	336,055	230,385
Italy	224,047	.....
Netherlands	85,557	160,286
United Kingdom	129,224	224,029
Other Europe	89,677	111,989
Japan	1,605,763	.....
Other countries	164,255	10,276
Sheets, strips and other forms	667,974	2,624,075
Dust	130,500	*157,341
Other zinc manufactures	221,045	96,236

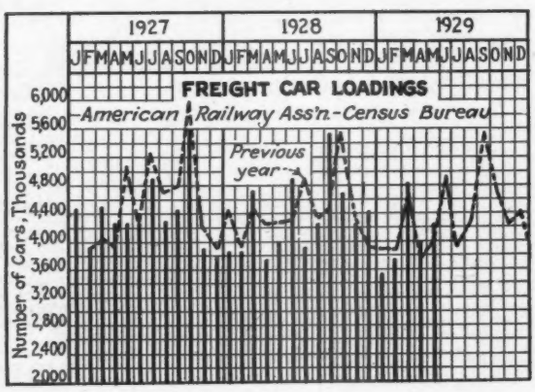
Indicators of Industrial Activity

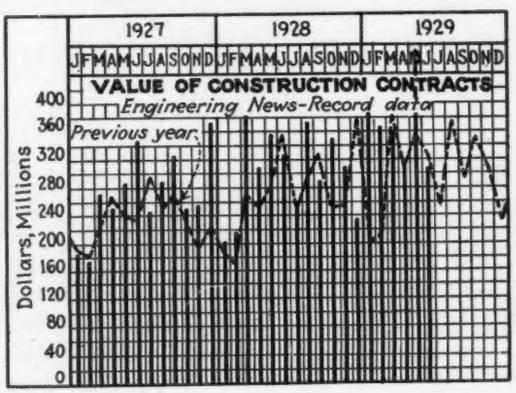
of Significance to Mining

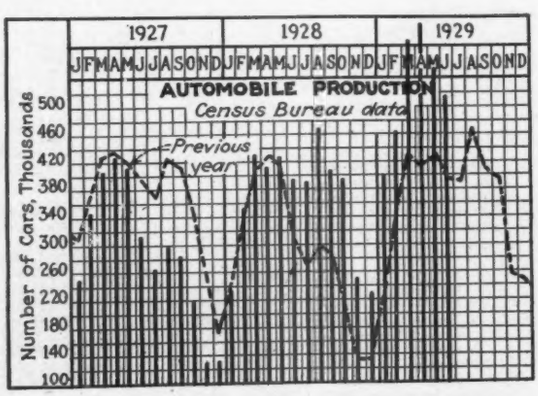


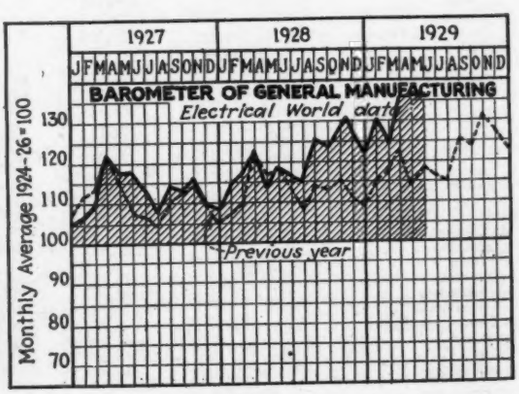












The Market Report

Copper Sentiment Improves

New York, July 31, 1929.—A marked improvement in the appearance of the copper market has been a feature of the last week. Sales in both domestic and foreign markets have been in considerably larger volume. Zinc and tin quotations are firm, with very little consumer buying. Lead has been somewhat more active, though price changes in this market appear to rest largely upon the trend of prices on the London Metal Exchange. The quicksilver market continues interesting, with a further advance in prices.

Daily Prices of Metals

July	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
25	17.775	47.00	6.75	6.55	6.80
26	17.775	47.125	6.75	6.55	6.80
27	17.775	No Market	6.75	6.55	6.80
29	17.775	47.125	6.75	6.55	6.80
30	17.775	47.25	6.75	6.55	6.80
31	17.775	47.25	6.75	6.55	6.80
	17.775	47.150	6.750	6.550	6.800

Average prices for calendar week ending July 27, 1929, are: Copper, 17.775; Straits tin, 47.250; New York lead, 6.75; St. Louis lead, 6.554; zinc, 6.800; and silver, 52.750.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic bid	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
25	72⅛	73	84	212¾	216¾	22½	22 11/16	25⅛	25¼
26	72¼	73¼	84¼	213	217	22⅝	22¾	25⅛	25¼
29	72 1/16	73 1/16	84¼	214¾	218½	23	23 1/16	25¼	25⅜
30	73¼	73⅛	84½	213⅝	217⅞	23	23⅛	25 3/16	25 5/16
31	73 3/16	73⅛	84¼	213½	217½	22¾	22⅞	25⅛	25¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	July	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
25	4.84 11/16	52⅜	24⅜	84s11½d	29	4.84 11/16	52⅜	24⅜	84s11½d
26	4.84 11/16	52⅞	24 7/16	84s11½d	30	4.85	52½	24½	84s11½d
27	4.84¾	52¾	24⅜	.....	31	4.84¾	52⅜	24 5/16	84s11½d

Average: Silver, 52.667c.; Sterling Exchange, 484.802c.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Average Metal Prices for July, 1929

COPPER:	
New York Electrolytic	17.775
London Standard Spot	72.152
London Electrolytic Spot	84.043
LEAD:	
New York	6.804
St. Louis	6.607
London Spot	22.810
London Forward	22.880
SILVER:	
New York	52.510
London	24.289
Sterling Exchange	484.560
ZINC:	
St. Louis	6.766
London Spot	25.332
London Forward	25.418
TIN:	
Straits	46.281
London	209.473
QUICKSILVER	121.654
ANTIMONY	8.543
PLATINUM:	
Refined	68.000
Crude	58.000
ALUMINUM 99 Per Cent Plus	24.300

Better Demand for Copper

Sentiment in the copper market has improved materially during the last few days. An important factor in this change of feeling has been the large sales by Copper Exporters, Inc., which have averaged better than 2,000 long tons per day during the last few days. Considerable improvement in the domestic market has been noted during the week, also. Open-market sales by producers on domestic account for the week ending today exceeded 10,000 tons for the first time since March 27. As has been true in preceding weeks, virtually all of the tonnage sold has been for early delivery by the custom smelters. Prices are unchanged at 18c. per pound, delivered, Connecticut Valley basis, in the domestic market, and 18.30c., c.i.f. usual European destinations, in the export market.

Good Demand for Lead

Lead demand improved considerably in the week ending today, an average of around a thousand tons a day being sold, the best business in six weeks. Monday was easily the best day, with the week-end accumulation of orders and a strong tone to the London market, though a good tonnage was also sold yesterday. The slight decline in London today was disappointing and unexpected, for American companies have found foreign business good, with quite heavy sales of futures. Domestic consumers are taking an increased interest in forward metal also, though about 25 per cent of the business was for prompt and 45 per cent for August. Demand has been well distributed, with some buyers taking good-sized parcels. Prices in the East are uniformly on a 6.75c., New York basis, which is the contract price of the A. S. & R., but in the Middle West a little

business was done both above and below the generally quoted level of 6.55c., St. Louis. Last Friday at least one lot was sold as low as 6½c., and on Monday at 6.525c.; on the other hand, September lead on Monday brought as high as 6.60c. Desilverized is in somewhat freer supply than chemical, though commanding a five-point premium in the city of St. Louis. The lead market is firm, and should London show a little more strength an increase in price here might be justified.

Correction—The average price of lead in St. Louis for the week ending July 24 was incorrectly published last week as 6.556c., the correct average being 6.554c.

Zinc Quiet

After several weeks of fair activity the zinc market has quieted down again. No indication of a weakness in prices is apparent, however. In several directions it is expected that considerable buying by galvanizers will be noted in the next few weeks.

Tin Dull

The tin market has been quiescent throughout the week, with practically no interest in futures, by either dealers or consumers, and only slightly more in prompt deliveries. Price changes have been inconsequential, the quotation today being about 47¼c. for spot Straits, and 48⅛c. for futures.

Silver Quiet and Steady

Fluctuations in the price of silver have been of little consequence during the last week, and the local market remained quiet and inactive. Daily reports from abroad indicated sales by China and only moderate purchases for India account.

Mexican dollars (old Mexican pesos): July 25th, 40c.; 26th, 40⅛c.; 27th and 29th, 40c.; 30th, 39⅞c.; 31st, 40c.

Foreign Exchange

Closing cable quotations on the principal European currencies on Tuesday, July 30, were as follows: Francs, 3.91$\frac{31}{32}$c.; lire, 5.23c.; and marks, 23.84c. Canadian dollars, ¼ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus. 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, 8⅝c. per lb. for all positions. Cookson's "C" grade, spot, 14c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots. $1.85 and up.

CADMIUM — Per lb.. New York: 80@95c. Active demand.

IRIDIUM — Per oz., $230@$240 for 98@99 per cent sponge and powder.

NICKEL—Per lb. ingot, 35c.; shot. 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $38@$40. Small lots bring up to $50. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, $68 per oz. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less.

QUICKSILVER — Per 76-lb. flask $123@$124. Pending developments abroad, where stocks are closely held, prices quoted are largely nominal. Good inquiry noted.

Prices of Chromium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Titanium, Tungsten, Vanadium, and Zirconium are unchanged from the issue of July 6.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $16.00 for near-by positions and $15.75 for future delivery. Western scheelite, $16.50 for October and November delivery. Bolivian scheelite available at $16 for August to December position. Keen demand reported from Europe for near-by positions.

Antimony, Chrome, Iron, Manganese, Tantalum, Titanium, Vanadium, and Zircon ores are unchanged from quotations in the July 6 issue.

No Change in Joplin Market

Joplin, Mo., July 27, 1929

Blende

	Per Ton
High	$46.30
Premium blende, basis 60%	$44.00@ 45.00
Prime Western, basis 60%	43.00@ 44.00
Table concentrate, 60%	41.00@ 43.00
Flotation concentrate, 60%	39.00@ 41.00
Average settling price	44.29

Galena

High	$87.90
Basis 80% lead	85.00
Average settling price	85.89

Shipments for the week: Blende, 12,059 tons; galena, 1,455 tons. Value, all shipments, $658,840.

Shipments for seven months: Blende, 372,806 tons; galena, 61,869 tons. Value all shipments for seven months, $21,555,230.

No overproduction of zinc ore has occurred in the Tri-State district. Only 8,440 tons more was produced in the first seven months of this year than was shipped. The total stock in bins is 46,200 wet tons, and only approximately 34,000 wet tons is unsold, little of which is subject to forced sale. The local press is, as last year, pointing to a probable overproduction in an effort to induce producers to hold the output to the demand, which in some quarters is translated into a present menacing stock in the bins, but there is no foundation for this idea. Smeltermen are handling the production of slab zinc in the same intelligent manner as last year. All of which should suffice to allay fear that the market price of zinc can be broken down by consumers witholding contracts.

Platteville, Wis., July 27, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$46.75

Lead Ore	
Lead, basis 80 per cent	$85.00

Shipments for the week: Blende, 554 tons; lead, none. Shipments for the year: Blende, 20,143; lead 1,140 tons. Shipments for the week to separating plants, 1,218 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the July 6 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) Per lb., 4c. Spot offerings light. Good demand.

SODIUM NITRATE — Per 100 lb., $2.07½ for spot deliveries.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate, and Zinc Oxide are unchanged from prices in the July 6 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105. Spiegeleisen, 19@21 per cent, $34 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.40@$1.45 f.o.b. works. Market firm.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrovanadium, Nickel Silver, and Yellow (Muntz) Metal are unchanged from prices in the July 6 issue.

Rolled Metals

LEAD SHEETS—10¾c. per lb. for full rolled and 11c. per lb. for clipped sheets.

Copper, Zinc, Monel Metal, and Nickel Sheets are unchanged from prices in the July 6 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of July 6.

Iron, Steel, and Coke

IRON—Per gross ton, Valley furnaces, Bessemer, $19; basic, $18.50; No. 2 foundry, $18.50.

STEEL—Base prices per gross ton Pittsburgh, billets and slabs, $35; plates, structural shapes, and soft steel bars, per 100 lb., $1.95.

COKE—Per gross ton, Connellsville furnace, $2.75@$2.85. Connellsville foundry, $3.75@$4.85. Byproduct coke. Ohio and Kentucky (Connellsville basis) $6.50: Buffalo and Detroit, $8.50@$9.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London Spot		Sterling Exchange	
	1928	1929	1928	1929	1928	1929
January	57.135	57.019	26.313	26.257	487.098	484.577
February	57.016	56.210	26.205	25.904	487.008	484.787
March	57.245	56.346	26.329	26.000	487.558	484.776
April	57.395	55.668	26.409	25.738	487.785	484.808
May	60.298	54.125	27.654	25.084	487.685	484.599
June	60.019	52.415	27.459	24.258	487.565	484.330
July	59.215	52.510	27.262	24.289	485.923	484.560
August	58.880	.....	27.096	.....	484.979	.....
September	57.536	.....	26.440	.....	484.654	.....
October	58.087	.....	26.727	.....	484.584	.....
November	57.953	.....	26.704	.....	484.492	.....
December	57.335	.....	26.349	.....	484.698	.....
Year	58.176	.....	26.746	.....	486.169	.....

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London Spot			
	Electrolytic		Standard		Electrolytic	
	1928	1929	1928	1929	1928	1929
January	13.854	16.603	61.912	75.551	66.575	78\602
February	13.823	17.727	61.670	78.228	66.381	83.538
March	13.845	21.257	61.148	89.153	66.443	98.356
April	13.986	19.500	61.678	81.036	66.500	89.405
May	14.203	17.775	62.554	75.026	67.216	83.727
June	14.527	17.775	63.664	74.338	68.738	84.013
July	14.527	17.775	62.881	72.152	68.670	84.043
August	14.526	.....	62.472	.....	68.750	.....
September	14.724	.....	63.522	.....	69.800	.....
October	15.202	.....	65.524	.....	71.935	.....
November	15.778	.....	68.080	.....	74.750	.....
December	15.844	.....	69.336	.....	75.000	.....
Year	14.570	.....	63.703	.....	69.230	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London			
	1928	1929	1928	1929	1928 Spot	1928 3 Mos.	1929 Spot	1929 3 Mos.
January	6.500	6.650	6.280	6.498	21.773	22.213	22.111	22.344
February	6.325	6.853	6.069	6.739	20.283	20.747	23.128	23.156
March	6.000	7.450	5.805	7.348	19.938	20.352	25.409	25.591
April	6.100	7.187	5.991	7.025	20.306	20.563	24.783	24.408
May	6.123	7.000	6.012	6.761	20.483	20.813	23.949	23.750
June	6.300	7.000	6.152	6.790	20.985	21.211	23.694	23.603
July	6.220	6.804	6.038	6.607	20.602	20.957	22.810	22.880
August	6.248	.....	6.056	.....	21.634	21.628	.....	.....
September	6.450	.....	6.286	.....	22.050	21.769	.....	.....
October	6.500	.....	6.318	.....	22.082	21.796	.....	.....
November	6.389	.....	6.222	.....	21.239	21.469	.....	.....
December	6.495	.....	6.343	.....	21.342	21.730	.....	.....
Year	6.305	.....	6.131	.....	21.060	21.271	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York		London	
	1928	1929	1928	1929
	Straits		Spot	
January	55.650	49.139	253.222	222.727
February	52.440	49.347	233.833	223.138
March	52.220	48.870	232.722	220.781
April	52.270	45.858	234.204	206.887
May	51.582	43.904	230.886	197.545
June	47.938	44.240	217.280	200.206
July	47.040	46.281	212.449	209.473
August	48.012	.....	212.847	.....
September	48.073	.....	215.663	.....
October	48.966	.....	222.005	.....
November	50.750	.....	232.875	.....
December	50.185	.....	227.586	.....
Year	50.427	.....	227.131	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1928	1929	1928 Spot	1928 3 Mos.	1929 Spot	1929 3 Mos.
January	5.643	6.350	26.125	26.051	26.196	26.233
February	5.551	6.350	25.518	25.506	26.247	26.347
March	5.624	6.463	25.082	24.960	27.050	27.294
April	5.759	6.658	25.493	25.316	26.759	26.613
May	6.026	6.618	26.102	25.756	26.727	26.619
June	6.158	6.686	25.664	25.429	26.216	25.984
July	6.201	6.766	24.946	24.972	25.332	25.418
August	6.249	.....	24.540	24.713	.....	.....
September	6.250	.....	24.497	24.625	.....	.....
October	6.250	.....	24.030	24.296	.....	.....
November	6.263	.....	24.801	24.827	.....	.....
December	6.349	.....	26.609	26.615	.....	.....
Year	6.027	.....	25.284	25.256	.....	.....

St. Louis quotations, cents per pound. London pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) Refined New York		Platinum (c) Crude New York	
	1928	1929	1928	1929	1928	1929	1928	1929
Jan.	10.863	9.558	123.620	119.481	79.280	70.000	69.280	60.000
Feb.	10.842	9.548	121.370	119.818	84.783	70.000	74.783	60.000
March	10.083	9.531	122.557	121.904	80.000	70.000	70.000	60.000
April	9.865	9.462	123.740	122.000	80.000	70.000	70.000	60.000
May	11.019	8.957	123.173	121.154	78.000	68.615	68.000	58.615
June	9.750	8.845	122.423	120.500	78.000	68.000	68.000	58.000
July	9.540	8.543	121.260	121.654	78.000	68.000	68.000	58.000
Aug.	10.181	.....	124.500	.....	78.000	.....	68.000	.....
Sept.	10.813	.....	128.000	.....	78.000	.....	68.000	.....
Oct.	10.841	.....	125.923	.....	78.000	.....	68.000	.....
Nov.	10.109	.....	123.000	.....	76.417	.....	66.418	.....
Dec.	9.748	.....	122.500	.....	74.480	.....	64.480	.....
Year	10.305	.....	123.506	.....	78.580	.....	68.580	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce.

Pig Iron[1] and Aluminum

	Bessemer		Basic		No. 2 Foundry		Aluminum	
	1928	1929	1928	1929	1928	1929	1928	1929
Jan.	17.50	18.00	17.00	17.50	17.25	17.50	24.300	24.300
Feb.	17.50	18.00	17.00	17.50	17.25	17.50	24.300	24.300
March	17.50	18.19	17.00	17.62	17.25	17.69	24.300	24.300
April	17.50	18.50	17.00	18.00	17.25	18.00	24.300	24.300
May	17.37	18.81	16.38	18.31	17.24	18.31	24.300	24.300
June	17.00	19.00	15.56	18.50	16.79	18.50	24.300	24.300
July	17.00	19.00	15.75	18.50	16.69	18.50	24.300	24.300
Aug.	17.00	.....	15.75	.....	16.50	.....	24.300	.....
Sept.	17.00	.....	15.75	.....	16.50	.....	24.300	.....
Oct.	17.24	.....	16.66	.....	16.74	.....	24.300	.....
Nov.	17.82	.....	17.32	.....	17.32	.....	24.300	.....
Dec.	18.00	.....	17.50	.....	17.50	.....	24.300	.....
Year	17.37	.....	16.56	.....	17.02	.....	24.300	.....

Iron in dollars per long ton. Aluminum in cents per pound, 99 per cent grade.

[1]F.o.b. Mahoning and Shenango valley furnaces; freight to Pittsburgh, $1.76.

Monthly Crude Copper Output in Short Tons

Domestic

	1928 Total	1929 Jan.	Feb.	Mar.	April	May	June
Alaska shipments	22,724	2,145	913	1,974	2,075	1,801	1,793
Calumet & Arizona	65,182	5,254	5,553	5,888	6,041	6,731	5,286
Magma	18,251	1,730	1,450	1,680	1,780	2,022	1,664
Miami	24,129	2,262	2,157	2,620	2,591	2,416	2,416
Nevada Con.	134,231	.....	.....	†39,191	.....	.....	.....
Old Dominion*	11,069	921	734	1,015	1,040	1,022	.....
Phelps Dodge††	102,137	9,850	9,537	10,524	10,230	9,857	.....
United Verde Extens.	22,073	2,338	2,024	2,504	2,682	2,732	2,510
Utah Copper	136,920	.....	.....	†40,500	.....	.....	.....
Tennessee Copper	6,792	597	616	635	619	676	638

Foreign

Andes Copper	52,029	7,485	7,000	8,300	8,263	7,393	.....
Braden	109,137	6,510	4,830	9,375	9,265	7,630	.....
Boleo, Mexico	12,782	.....	.....	†2,910	.....	.....	3,637
Bwana M'Kubwa	6,696	812	605	686	615	317	536
Chile	132,932	15,645	15,085	16,720	.....	.....	.....
Furukawa, Japan	17,865	1,420	1,473	1,751	1,350	.....	.....
Granby Cons., Canada	28,767	2,677	2,324	2,452	2,631	2,591	2,518
Howe Sound	21,099	.....	.....	†5,157	.....	.....	.....
Mt. Lyell	6,582	.....	.....	1,707	.....	.....	.....
Sumitomo, Japan	17,898	1,502	1,335	1,680	1,657	.....	.....
Union Miniere, Africa	123,880	9,753	9,477	11,820	12,810	13,224	12,673

†Three months. *Includes Arizona Commercial.
††Moctezuma is included.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1927 Monthly Production	1927 Daily Rate	1928 Monthly Production	1928 Daily Rate	1929 Monthly Production	1929 Daily Rate
January	76,198	2,458	68,469	2,209	86,325	2,785
February	69,202	2,472	67,423	2,352	84,735	3,026
March	69,314	2,236	70,327	2,269	93,698	3,023
April	71,122	2,371	69,721	2,324	94,902	3,163
May	71,613	2,310	73,729	2,378	93,392	3,013
June	69,539	2,318	73,224	2,441	82,841	2,761
July	65,545	2,114	73,426	2,369	.....	.....
August	67,248	2,169	76,952	2,482	.....	.....
September	65,936	2,198	78,341	2,611	.....	.....
October	68,545	2,225	86,480	2,790	.....	.....
November	68,080	2,269	85,382	2,846	.....	.....
December	67,377	2,173	85,677	2,764	.....	.....
Total	829,978	.....	909,051	.....	535,893	.....
Monthly average	69,165	.....	75,754	.....	89,316	.....
Average of daily rate	.....	2,274	.....	2,484	.....	2,961

Mining Stocks—Week Ended July 27, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda Copper	New York	116⅛	111	112⅜	Jl.13, Au. 19	Q 1.75
Andes Copper	New York	52⅛	49⅛	50⅛	Jl. 13, Au. 12	Q 0.75
Arisona Com	Boston	2⅜	2⅛	2⅛	Jl. 16, Jl. 31	SA 0.25
Calumet & Aris	New York	129	127⅛	127⅛	My.31, Je.17	Q 2.50
Calumet & Hecla	Boston	41⅛	40½	41⅛	My.31, Je.29	Q 1.00
Cerro de Pasco	New York	95⅛	93	93	Jl.11, Au. 1	Q 1.50
Con. Coppermines	N. Y. Curb	11	10⅛	10⅛		
Copper Range	Boston	22	21	21	Je. 15, Jl. 15	Q 0.50
East Butte	Boston	2⅛	2⅛	2⅛	Dec., 1919	0.50
Granby Con	New York	79⅛	76	76⅛	Jl.12, Au.1	Q 1.75
Greene Cananea	New York	174⅛	169⅛	171⅛	Je. 6, Jl. 1	Q 2.00
Howe Sound	New York	69⅛	66⅛	67⅛	Je. 29, Jl. 15	Q 1.50
Hudson Bay	N. Y. Curb	16⅛	16⅛	16⅛		
Inspiration	New York	44⅛	42⅛	43⅛	Je.13, Jl. 1	Q 1.00
Isle Royale	Boston	21⅛	21	21	My. 31, Je.29	0.50
Kennecott	New York	87⅛	84⅛	84⅛	My. 31, Jl. 1	Q 1.25
Magma Copper	New York	67	65	66	Je.28, Jl.15	Q 1.25
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Miami Copper	New York	43⅛	41⅛	42⅛	Au. 1, Au. 15	Q 1.00
Mohawk	Boston	58	56⅛	58	Jl. 31, Se. 2	Q 2.00
Mother Lode	New York	3⅛	3	3	Je. 13, Je. 29	0.20
Nevada Con	New York	46⅛	43⅛	44⅛	Je. 14, Je. 29	Q 0.75
Noranda	N. Y. Curb	58⅛	57⅛	58		
Ohio Copper	N. Y. Curb	1⅛	1⅛	1⅛	Sept., 1926	0.03
Old Dominion	Boston	10⅛	9⅛	9⅛	Dec., 1918	1.00
Phelps Dodge	New York	....	....	61	Je. 4, Jl. 1	Q 0.75
Quincy	Boston	45⅛	36	45	March, 1920	1.00
Roan Antelope	N. Y. Curb	44⅛	39⅛	42⅛		
St. Mary's M. L.	Boston	37⅛	33⅛	37⅛	Fe.25, Mr.12	2.00
Seneca Copper	New York	5⅛	4⅛	4⅛		
Shattuck Denn	N. Y. Curb	16⅛	15⅛	15⅛		
Sherritt-Gordon	Toronto	7.85	7.40	7.45		
Tenn. C. & C.	New York	18⅛	17⅛	17⅛	Au.31, Se.16	Q 0.25
United Verde Ex	N. Y. Curb	16⅛	15⅛	15⅛	Jl. 2, Au. 1	Q 1.00
Utah Copper	New York	303	303	303	Je. 14, Je. 29	Q 4.00
Waite-Ack.-Mont	Toronto	6.10	5.75	5.90		
Walker Mining	Salt Lake	4.85	4.20	4.85		
Wenden Copper	N. Y. Curb	1⅛	1	1		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	1⅛	1⅛	1⅛		
Amer. Z. L. & S.	New York	24⅛	22⅛	23⅛	May, 1917	1.00
A. Z. L. & S., pfd.	New York	91⅛	90⅛	91⅛	Je.14, Jl. 1	1.50
Bunker Hill & S.	N. Y. Curb	....	....	131	Ap.25, My.6	X 0.75
Butte Cop. & Zn.	New York	4⅛	4⅛	4⅛		
Butte Cop. Con.	Boston Curb	*36	*30	*32		
Butte & Sup.	New York	8	8	8	Je. 14, Je. 29	Q 0.50
Callahan Zn-Ld.	New York	1⅛	1⅛	1⅛	Dec., 1920	0.50
Chief Consol.	Salt Lake	3.55	3.33	3.55	Fe. 1, 1928	K 0.10
Consol. Ld. & Zn. "A"	St. Louis	11⅞	11	11	Je.20, Jl.1	Q 0.25
Constitution	Spokane	*69	*48	*48		
Dayrock	Spokane	3.65	3.00	3.60	Je.20, Je.30	0.03
Dickens Consol.	Spokane	*7⅛	*5⅛	*5⅛		
Eagle-Picher	Cincinnati	19⅛	17⅛	19⅛	Je. 30, Jl.15	Q 0.20
Eagle-Pich., pfd.	Cincinnati	....	....	102	Je. 30, Jl. 15	Q 1.50
Erupcion	Boston Curb	*12	*12	*12	Ja. 1, 1928	Q 0.07½
Eureka Bullion	Salt Lake	*83	*80	*80		
Eureka Lily	Salt Lake	....	....	*33		
Eureka Standard	Salt Lake	....	....	1.42½		
Evans-Wallower	N. Y. Curb	17⅛	16	16		
Evans-Wal., pfd.	N. Y. Curb	....	....	70	Je.20, Jl. 1	Q 1.75
Federal M. & S.	New York	....	....	280	Je., 1927	10.00
Fed. M. & S., pfd.	New York	....	....	104½	My.24, Je.15	Q 1.75
Gladstone	Spokane	*8⅛	*8	*8		
Golconda	Spokane	1.08	1.00	1.04	Je.15, Jl.1	0.02
Grandview	Spokane	*43	*41	*41		
Hecla Mining	N. Y. Curb	19	17	18⅛	My.15, Je.15	Q 0.25
Highland-Surprise	Spokane	*13⅛	*13⅛	*13⅛		
Jack Waite	Spokane	*10	*9⅛	*9⅛		
Kootenay Florence	Spokane	*15⅛	*12⅛	*15		
Lucky Jim	Spokane	*9	*9	*9		
Lucky Tiger-C.	Kansas City	†3.25	†3.00	....	Jl. 5, Jl. 20	0.02½
Mexican Premier	Spokane	2.50	2.42	2.50		
National Lead	New York	152⅛	145	145⅛	Se. 13, Se. 30	Q 1.25
Natl. Lead, pfd. A	New York	138⅛	138⅛	138⅛	Au.30, Se. 14	Q 1.75
Natl. Lead, pfd. B	New York	118	117	117	Oc. 18, No. 1	Q 1.50
N. J. Zinc, new	N. Y. Curb	83⅛	82⅛	83⅛	Jl.20, Au.10	Q 0.50
New Quincy	Salt Lake	2.27⅛	1.95	2.27⅛	My.15, My.27	Q 0.10
Noble Five	Spokane	*60	*60	*60		
North Lily	Salt Lake	6.50	5.95	6.10	Jl.16, Jl.20	Q 0.25
Park Bingham	Salt Lake	....	....	8⅛		
Park Utah	New York	6⅛	5⅛	6⅛	Je. 14, Jl. 10	Q 0.20
Pend Oreille	Spokane	5.60	5.25	5.25		
Rico Argentine	Salt Lake	*38	*35	*36	No. 30, De. 15	Q 0.03
Ruth-Hope	Spokane	*34	*30	*32		
St. Joseph Lead	New York	66	59⅛	65⅛	Se.10, Se.20	QX 0.75
Sherman Lead	Spokane	*56	*52	*53		
Silver King Coa.	Salt Lake	13	13	13	Je. 20, Jl. 1	0.25
Silversmith	Spokane	*9⅛	*9	*9⅛	Oct., 1926	Q 0.02
Sunshine Mining	Spokane	4.53	3.45	4.50	Je. 10, Je. 20	Q 0.05
Tamarack-Custer	Spokane	*92	*80	*90	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.75	13.25	13.75	Je. 17, Je. 29	QX 0.30
Tonopah Belmont	N. Y. Curb	....	....	*56½	Oct., 1925	0.05
Treadwell-Yukon	Toronto	9.05	9.00	9.05		
United Zinc Smg.	N. Y. Curb	*93⅛	*87⅛	*87⅛		
Utah Apex	Boston	3⅜	3⅛	3⅛	May 15, June 1	0.25
Utah Met. & Tun.	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Whitewater	Spokane	*70	*55	*55		
Yellow Pine	Los Angeles	....	....	*8	Dec., 1925	QX 0.04
GOLD						
Alaska Juneau	New York	6	5⅛	5⅛		
Barry-Hollinger	Toronto	*28⅛	*27	*27		
Central Manitoba	Toronto	*47	*41	*47		
Cresson Consol.	N. Y. Curb	*68⅛	*62⅛	*62⅛	Mr.30, Ap.10	Q 0.02
Dome Mines	New York	10	9⅛	9⅛	Jl. 20,	Q 0.25
Golden Cycle	Col. Springs	†1.83½	†1.80½	....	Fe.15, Mr. 1	0.04
Gold Hill	Toronto	....	....	*1⅛		
Hollinger	Toronto	6.10	5.60	6.05	Jl.26, Au. 12	FW 0.05
Homestake	New York	75	75	75	Jl.20, Jl.25	M 0.50
Kirkland Lake	Toronto.	*88	*82	*83		
Lake Shore	Toronto	25.25	25.00	25.25	Je.1, Je.15	Q 0.20
McIntyre-Porc.	New York	15⅛	15⅛	15⅛	Au.1, Se.2	Q 0.25
Portland	Colo.Springs	†*10	†*8	....	April, 1927	0.02
Rand Mines	New York	35	34⅛	35	Fe. 21,'28	Am.Sh. 1.52
Siscoe	Toronto	*70	*60	*64		
Sylvanite	Toronto	1.25	*95	1.10		
Teck-Hughes	Toronto	8.40	8.25	8.25	Jl. 18, Au. 1	0.15
Tom Reed	Los Angeles	*70	*63	*68⅛	Dec., 1926	0.02
Unity Gold	N. Y. Curb	1⅛	1⅛	1⅛		
Vipond Consol.	Toronto	*95	*80	*84	April, 1927	0.03
Wright-Hargreaves	Toronto	1.80	1.70	1.74	Oc. 16, No. 1	0.02½
Yukon-Alaska	N. Y. Curb	....	....	35⅛		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	20	19⅞	20		
Castle-Trethewey	Toronto	*30	*30	*30		
Consol. Cortez	N. Y. Curb	....	....	*12⅛		
Dolores Esperanza	N. Y. Curb	*87⅛	*81⅛	*81⅛	July, 1923	0.05
Keeley	Toronto	*46	*46	*46	Mr.15, 1928	0.04
Mining Corp.	Toronto	4.10	3.95	3.95	My.30, Je.13	0.12½
Montana-Idaho	Spokane	*8⅛	*8	*8		
N. Y. & Hond. Ros.	N. Y. Curb	....	....	16⅛	Jl.17, Jl.27	QX 0.50
Nipissing	N. Y. Curb	2⅛	2⅛	2⅛	Je.29, Jl.20	Q 0.07½
Premier Gold	N. Y. Curb	1⅛	1⅛	1⅛	Je.13, Jl.3	Q 0.06
Tonopah Exten.	N. Y. Curb	....	....	*10	April, 1925	0.05
Tonopah Mining	N. Y. Curb	3	3	3	Ap. 7, Ap. 20	0.07½
United Eastern	N. Y. Curb	....	....	*56⅛		
Yukon Gold	N. Y. Curb	*68⅛	*62⅛	*68⅛	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	124⅛	117⅛	123	Oc. 18, No. 15	Q 1.50
Beth. Steel, pfd, 7%.	New York	124⅛	115⅛	122	Se.6, Oc. 1	Q 1.75
Cleveland-Cliffs	Cleveland	99	97⅛	98⅛	Je. 6, Je. 15	5.00
Colo. Fuel & Iron	New York	72⅛	66⅛	67⅛		
Colo. F. & I., 1st pfd.	New York	....	....	133	Au.10, Se.26,	Q 2.00
Great Northern Iron	New York	32	30⅛	30⅛	Dec.15,	K 2.00
Inland Steel	New York	98⅛	94⅛	96	My.15, Jn. 1,	Q 0.87½
Republic I. & S.	New York	114⅛	109⅛	110⅛	My. 11, Je. 1,	Q 1.00
Republic I. & S., pfd.	New York	112⅛	112⅛	112⅛	Je.12, Jl. 1,	Q 1.75
Sloss-Sheffield S. & I.	New York	62	61	61	Mr. 11, Mr.20,	Q 1.50
Sloss-Sheff. S. & I., pfd.	New York	85⅛	85⅛	85⅛	Je.20, Jl.1,	Q 1.75
U. S. Steel	New York	210⅛	204⅛	206		
U. S. Steel, pfd.	New York	140⅛	139⅞	140	My. 4, My 29,	Q 1.75
Virginia I. C. & C.	New York	22	21	21⅛	Jan., 1924	1.50
Virginia I.C.& C., pfd.	New York	41	40	40	Jl.16, 1928	SA 2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	445	430	445		
Alum.Co.of Amer., pf.	N. Y. Curb	106	104⅛	106	Mr.15, Ap.1,	Q 1.50
American Metal	New York	65⅛	62	67	Au. 21, Se. 1	Q 0.75
Amer. Metal, pfd., 6%	New York	122	120⅛	120⅛	Au. 21, Se. 3	Q 1.50
Amer. Sm. & Ref.	New York	111⅛	106⅛	110⅛	Je. 30, Jl. 12	Q 1.00
Amer. & Sm. Ref., pfd.	New York	134⅛	133⅛	134⅛	Au. 3, Se. 1	Q 1.75
Ang. Ch. Nitrate	N. Y. Curb	37⅛	34⅛	37		
Asbestos Corp.	Montreal	11	10⅛	11	Jan. 1926	1.50
Asbestos Corp., pfd.	Montreal	32⅛	31	31	De. 31, Ja. 15	Q 1.75
Consol. M. & S.	Montreal	390	390	390	Je.29, Jl.15,	SAX 6.25
De Beers Consol.	New York	....	....	23	Jl. 23, Jl.26,	Q 0.96
Federated Metals	N. Y. Curb	33	33	33	Je.25, Jl.5	Q 0.75
Freeport Texas	New York	43⅛	41⅛	43	Jl. 5, Au.1	Q 1.00
Int. Nickel Can.	New York	48⅛	46⅛	47⅛	Je.1, Je.29	Q 0.20
Int. Nickel, pfd.	New York	....	....	122	Jl.1, Au.1	Q 1.75
Mayflower Assoc.	N. Y. Curb	75⅛	73⅛	75		
Metal & Mining	N. Y. Curb	19	19	19	Je.20, Jl.1	Q 0.30
Newmont	N. Y. Curb	214	203⅛	204	Je.29, Jl.15	Q 1.00
Patiño M. & E.	New York	41	40⅛	40⅛	My. 31, Jn. 28	4a
So. America G. & P.	N. Y. Curb	2⅛	2⅛	2⅛		
Texas Gulf Sulphur	New York	74	71⅛	72	Je.1, Je.15	Q 1.00
U. S. Sm. R. & M.	New York	50⅛	53⅛	53⅛	Jl. 5, Jl. 15	Q 0.87½
U. S. Sm. R. & M., pfd.	New York	53	52⅛	53	Jl. 5, Jl. 15	Q 0.87½
Vanadium Corp.	New York	94⅛	87⅛	87⅛	Au.1	Au. 15 Q 0.75

Toronto Standard Stock Exchange, Toronto, courtesy the Arthur E. Moysey Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I, Initial. R, Resumption. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

LONDON QUOTATIONS—WEEK ENDED July 16, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	20/—	20/—	20/—		
Alaska Treadwell (25)	61/3	57/6	60/—	Nov., 1926	4p.c.(d)
Aramayo Mines (25 frs.)	62/6	61/—	61/3	May 1929	5p.c.(†)
Burma Corp (10 rupees)	19/—	18/7½	18/9	July 1929	9 annas*
Bwana M'Kubwa (5s)	22/3	20/10½	21/3		
Camp Bird (2s)	2/1½	2/—	2/1½	April, 1928	1½ p.c.
El Oro (5s)	3/—	2/5	3/—	Nov., 1924	2½ p.c.*
Frontino & Bolivia (£)	7/10½	7/—	7/6	Jan., 1929	3½ p.c.
Mexican Corpn. (£1)	16/10½	16/—	16/3		
Mexico Mines of El Oro (£1)	6/9	6/3	6/3	Dec., 1926	3½ p.c.*(c)
Mount Isa (£1)	43/3	42/1½	43/1½		
N'Changa Copper Mining. (£1)	75/—	70/—	71/3		
Oroville Dredging (4s)	1/—	1/10½	1/10½	Nov., 1928	31½ p.c.
Rhodesian Congo Border (£1)	203/9	192/6	192/6		
St. John del Rey (£1)	17/1½	16/—	17/3	Apr., 1929	7½ p.c.
San Francisco Mines (10s)	37/—	35/6	36/3	June 1929	15 p.c.
Santa Gertrudis (£1)	11/—	9/7½	9/9	July 1929	7½ p.c.
Selukwe (2s. 6d.)	7/7½	5/9	7/3	April, 1917	6½ p.c.
S. Amer. Copper (2s.)	3/3	2/10½	3/—	Nov. 1917	75 p.c.
Tanganyika (£1)	62/6	57/6	58/9	July, 1928	5 p.c.
Union Miniere du Haut-Katanga (Brussels)	11,050	11,000	11,050	April, 1929	300 fr.(‡)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian francs and free of taxation. (d) U. S. Dollars. (c) July, 1929, ex ½d. return of capital.